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EDITORIAL NOTES.

The Old Wish.

IT does not often occur that, in a technical and trade paper such as this, an opportunity is given to depart from the material affairs of the industrial world concerned, and to get into closer touch with the personal and domestic side of our readers' lives. This issue of the "JOURNAL" will reach our Provincial and Continental readers within a few hours of Christmas Day. May we therefore wish all readers and their families over whom there is no shadow of an immediate sorrow "A Merry Christmas Time," and add the hope that the season of relaxation and reunion may knit stronger than ever those bonds of happiness in family circles that do so much to brighten the course of life and lighten its cares and burdens. A large number of readers are situated in distant climes to reach which days and even weeks are required. Although they will not see this wish of ours before the festive day, they will know that they, too, were not absent from our thoughts.

Total Heat Value.

EARLY in the New Year, we shall be making our customary review of the gas measures introduced for the session of Parliament commencing in February; but, meanwhile, three or four of the principal Bills are being specially noticed this week. Two of them are the Gaslight and Coke Company's and the Liverpool Gas Company's; and both these, among several others, deal, as former articles have mentioned, with the calorific power standard. We have not yet carefully examined the other Bills, but, in both these cases, we see that the promoters are taking steps to accord to their gas its total value in the testing for its thermal power. The calorific clauses in the Bills are perfectly in consonance with the lines that have been laid down as generally suitable in the matter of conditions as apart from the numerical terms of a standard. In the coming session, we ought to get to uniformity in this matter, and not be having some promoters seeking to prescribe "net" value instead of "gross," and "calories per cubic foot" instead of "B.Th.U. "per cubic foot." Probably, too, the Gaslight and Coke and Liverpool Companies will succeed in convincing Parliament that the gas ought to be tested to obtain credit for its total heat value. This is a point on which comment was made in our issue for Dec. 9 (p. 793). The United States Bureau of Standards have recommended that, in the prescribing of calorific standards, the total heat value should be taken; and the point has been raised more than once in articles in our columns and in lectures before technical societies. We do not think it should require much argument to convince as to the fairness of this; and evidently both the Gaslight and Coke and the Liverpool Companies are of similar view, for they are going to ask for the concurrence of Parliament in a "total heat" prescription. The premier Company are proposing to provide that the apparatus prescribed by the Gas Referees for testing the calorific power of the gas shall be the most suitable for ascertaining, and in making the test shall be used in such a manner and under such conditions as to ascertain, after any necessary calculations have been made, the "total heat value" of the gas. In the case of the Liverpool Bill, the Company desire that the calorimeter, to be agreed upon between the Corporation and themselves, or failing agreement to be approved by the Board of Trade, shall be capable of being, and shall be, so used as to yield the "total heat value" of the gas expressed in B.Th.U. The point is an interesting and important one, and may as well be dealt with at once, instead of later on having the same trouble as occurred in connection with the standard test-burners, which resulted in the devising of the "Metropoli-"tan" No. 2 burner, in order that the gas should have conferred upon it credit for its full ability in the matter of illuminating power.

Electrical Futurists and Gas Supply.

THE question of the future of electricity generation has again been brought prominently forward by the revival of the idea of centralizing the generation of electricity for London—not necessarily at a single station, but at fewer stations than now exist. Dr. Klingenberg has been addressing the Institution of Electrical Engineers on the subject, and electrical engineers are all in a state of effervescing curiosity to hear what is going to happen in regard to the Bill that the County of London Electric Supply Corporation are going to promote in the next session of Parliament, which Bill (according to some reports) has at the back of it a scheme for erecting a large generating station at Barking, and the supply from it of current in bulk to the present purveyors of electrical energy. But it is necessary for the carrying out of this scheme that the date for the authorized purchase by the London County Council of the electricity supply concerns of London—August, 1931—should be deferred. The scheme has given rise to all sorts of rumours as to a big amalgamation of all the electricity companies of London, and, in fact, a circular-letter has been sent out to ascertain the views of the companies on the subject. One report foreshadows a 19 million capital amalgamation, of which sum 4½ millions would represent new capital. However, the real decision rests with the London County Council, as the whole matter was threshed out in Parliament a few years ago, with memorable immensity and minutiæ; and Parliament thought proper to unify matters by conferring upon the County Council purchase powers to become operative in the year named, or at intervals thereafter of ten years. Therefore the Council are not likely to voluntarily relinquish their present position. However, we shall hear more of their attitude when they have had an opportunity of digesting the Bill of the Electric Corporation.

Meanwhile we have Dr. Klingenberg coming here and telling the London electrical engineers that they made a sad mistake in committing London to the untender mercies of a great number of small supply stations. The London engineers hardly required to be told this, as it was not to them new information. In fact, Mr. S. Z. Ferranti says that the existing state of things is about the "maddest" that could have been established for the electric supply of London. But now that it is here, the correct thing is to make the best possible of it. Dr. Klingenberg's answer to this is that the best possible is to adopt some such scheme of centralization as he proposes; and he calculates that the reduced working costs would more than compensate for the scrapping that would have to take place of a number of the existing stations. In order to illustrate what he believes could be done, he takes Chicago and Berlin as examples; but when his figures are examined, there does not appear much in the proposal for the user of current in comparison with what already exists. There are among the more modern generating plants in London those that are producing electrical energy at a cost that about equals in lowness the bulk stations referred to by our cosmopolitan friend, and the line of economy at the other stations will naturally be raised as extensions or supersession of plant is made. Examining the average price charged in London for electrical energy, Mr. J. F. C. Snell finds it is 2¼d. per unit, compared with 2·43d. for Chicago. It is perfectly evident that Dr. Klingenberg has not made a thorough examination of the problem of the electricity supply of London, nor does he know much about its internal affairs. However one looks at the question, there does not at present appear to be in any centralization scheme any great economy under current conditions.

Messrs. Snell, Ferranti, A. H. Seabrook, and W. C. P. Tapper—all of the foremost rank in electrical engineering—cannot at present see there is anything much in the idea of centralization, in view of the existing electrical position and the geographical and other circumstances of London, though Mr. Seabrook thinks the day may come when current in bulk may be supplied from the Kent coalfields.

The supposition that overhangs all this talk of centralization is that it would secure the supply of cheaper current. The electricity companies strongly contested this view when Mr. C. H. Merz had his power scheme for all London in Parliament a few years ago. However, it is in regard to the question of cost that our interest attaches to a centralization scheme, as enthusiasts like Dr. Klingenberg and Mr. Ferranti are of opinion that, if electricity supply could be cheapened, then all means of obtaining heat by combustion for any purpose would be wiped out by the electrical heat-producing energy. Imagination carries some folks a long way; but the day when electricity is going to sweep everything before it in this revolutionary manner has not yet been fixed upon by any prophet—electrical or otherwise. The German adviser of what London electrical engineers ought to do states that "electricity is now univer- "sally acknowledged to be the most suitable form of energy "supply for large cities, and, apart from the convenience "and reliability, its wide range of application makes it "superior to gas." The universality of the acknowledgment does not appear to be reflected in the expansion of the business of the gas undertakings; nor is the reliability of electricity attested by a consistent record of failures since public electric supply first started. As to the range of electricity applications—well, of course, the success of this range depends upon the value and the convenience that the user realizes in comparison with any other agent. We are not foolish enough to suggest that electricity cannot claim some applications for which it is superior to gas; we are not so foolish as to agree with those electricians who think, or pretend to believe, that there are not uses in which gas can offer better value and service than electricity.

Dr. Klingenberg, as already remarked, does not appear to know very much as to the internal conditions of London. One of the internal conditions is the present price of gas—gas which is used so largely for heating and cooking. The ordinary charges (omitting contract rates) range from 2s. 2d. to 2s. 6d. per 1000 cubic feet; whereas in Chicago the price is 3s. 4d., and in Berlin 3s. 6d. Before indulging in random talk, and suggesting a walk-over, it is just as well to consider the question of the position of the competitors. The competitors in this instance are not standing still. They, too, are considering the ways of reducing, as far as possible, their net "generating costs," and we rather think that the maximum judicious production of B.Th.U. per ton of coal, instead of cubic feet, is going to do a great deal for the citizens of London in providing them with a clean, convenient, reliable, and cheap fuel, which will still maintain the function of combustion as an important one in the whole length and breadth of this great Metropolis of ours. So when Dr. Klingenberg admits that the reason electricity has hitherto been unable to drive its competitors out of the field is solely due to the difference in price for the same amount of energy, he might, at the same time, give those in charge of at least one of the competitors the credit for not having arrived at the end of their tether in the matter of economical production—providing that the prices of coal and residuals are favourable.

At the present time, the London electricity generating stations are among the greatest sinners in the matter of the use of crude coal under their boilers. The electrical engineers realize this. They see the waste of valuable constituents of the coal; and hardly a week now passes without, in one or other of the electrical organs, someone is making reference to the gasification of coal, and to the recovery of the tar, nitrogen, &c.—the gas being used for the generation of current. Dr. Klingenberg referred to this in his paper; Mr. Seabrook looks amiably upon it as a possibility for electricians in the future; and Mr. Tapper re-echoes what has so often been advocated before, that the economical treatment of coal might be secured by the co-operation of gas and electricity authorities. "Gas authorities," he says, "being experts in the gasification of coal, might continue "their operations on a larger scale, and supply electricity "authorities with gaseous fuel for boiler firing or internal "combustion purposes." Next year several gas companies and corporation gas committees are asking Parliament to confer a calorific power standard upon them in place of an illuminating power one. This is the serious beginning of a new order of things in the gas industry; and the result has to be seen. There is no immediate hurry for co-operation between the gas and electricity industries in respect of the supply and purchase of gaseous fuel. We shall have to see how things develop. Of this there may be full assurance, that the gas industry will never depreciate the quality of its gas to an extent that will interfere with its service to the public, and so, by default, place a larger business in the hands of the electricity suppliers. However, no one can yet foresee what will happen in this matter of the supply of gaseous fuel to electricity generating stations, and so save them from all fuel troubles, storage, chimney shafts, and much else that is undesirable wherever it can be averted. Several electricians seem to view the idea favourably, but, so far, the question has been approached from their side only. They may, however, depend upon this, that the gas industry is taking a very broad view of the future, and, in doing so, its administrators and professional men will not lose sight of all possible sources of power business—electricity stations, as well as other industrial establishments.

Conspiracy.

THE condition of affairs that faced Leeds last week is one which calls for the serious consideration of communities generally; for it amounted to nothing short of a dastardly conspiracy on the part of municipal employees, who were led, or rather misled, by socialistic officials of their union. It was, we say it deliberately, a conspiracy of the worst type against the community—a conspiracy entered into by the persuasion of the unionist strife-raisers solely for the purpose of securing for the community's well-paid servants an all-round advance of 2s. per day per man. It was not so much the request for the advance that was objectionable, but the manner of trying to enforce it was not only obnoxious, but altogether tyrannous and despicable. These men working in different departments of the public service who entered into this alliance to produce such conditions as would compel compliance with their demands were, as municipal servants, already in a more favoured and a better protected position than the large mass of ratepayers of the labouring and the artizan class who are their masters. Nevertheless, at the risk of disorganizing the whole life and work of the city, of preventing large bodies of other men working who had no grievance although less favoured, and of producing conditions of insanitation and peril (fortunately unsuccessful) by cutting off water, gas, and electricity supplies, they sought to gain advantages superior to the other workers of the city in the service of private firms.

As we look back upon last week's events at Leeds—at the abuse of all British traditions, at the cowardly methods adopted, at the breaking of legal notices which were of the terms of the men's agreements as municipal employees—we cannot help feeling that a conspiracy of the kind to attack a community by an attempt to bring about a complete cessation of the public services ought to be a matter that should be dealt with very severely. It should, in fact, be made a criminal offence to create, incite, and encourage civic sedition such as has been seen at Leeds. What has happened, too, provides a very good argument against public supplies being all concentrated in the hands of the municipal authority; for, in such cases as the present, the gas, electricity, water, and tramway services all being in the hands of the local authority give their employees, through combination and the power of sudden and simultaneous action, a weapon to be used against the community of a very serious character, and a weapon such as no other body of workers could command. If this strike had happened in Australia, there would have been—as in the case of Sydney early this year—a wholesale prosecution of the gas workers; but at Leeds, although the men in the Gas and Water Departments come under the Conspiracy and Protection of Property Act, so far as we can see the Act is likely to be a dead-letter.

However, we congratulate the City Council on the strong stand they made rather than submit to unfair demand, or yield to the conditions which the strikers were able to menace as the result of municipal ownership, and which conditions, had they matured, would have placed in their unruly hands a very trenchant and effective weapon. We congratulate, too, the citizens upon the tolerant spirit they displayed under the circumstances, and upon the support rendered to

their municipal government. The methods adopted by the municipal workers—gas, electricity, water, tramway, scavenging, and others—to try to coerce the Council by inconveniencing the whole body of ratepayers and by paralyzing the life and work of the city, did not appeal to the community generally, and the community stiffened its back, showed resentment, and went solidly over to the side of the Council. Such tactics will not do. The strikers very quickly saw that public sympathy was not with them; and they soon began to see, too, that modern industrial methods make it far easier than heretofore for a community to reply in a very effectual manner to concerted action against public convenience and peace. The water and electricity supplies were fully maintained, and the curtailment of the gas supply was only a temporary matter. University students and pupils from engineering works who had never worked in a retort-house before, or in an electricity generating station, were soon volunteering their services, with an effect that was appalling to the half-hearted strikers, and an incitement to additional blatancy on the part of those who normally suffer from that characteristic. The students at the University and the engineering works pupils acted splendidly. What they did was entirely on their own volition; and they filled the part of true citizens in the cause of right, law, and order. Who could say them "Nay?" Those students and engineering pupils were the first line, and an effectual line, in the defence of the community against those who conspired against it. Apart from this, the offers by men who wanted work to take employment under the Corporation reduced the misled strikers to a pitiful and foolish condition. By the middle of the week, it was clearly seen that the strikers were not going to be the victors. The Corporation, however, were generous. They did not desire to be hard on those who had, through ill-advice, treated municipal service and the community in so contemptible a manner; and at the end of the week, they gave the men the opportunity of taking up their employment again, rather than give the positions to strangers.

This Leeds business has been a miserable fiasco from the men's point of view. At the beginning of the strike the Union leaders had marked out their plan of campaign. First Leeds was to be brought into subjection; and then Manchester and Liverpool were to be taken in hand, with probably a few smaller fry dealt with in passing. But what will the municipal workers of Manchester and Liverpool say now? They will want, if we are not mistaken, to see the nature of the credentials that the Union leaders bring from Leeds before making the same mistake experienced by their crestfallen equals at Leeds. If we know the Manchester and Liverpool men, they are not likely to court the same disaster; and they will, after Leeds, require to be very sure of their ground. If the Union leaders are wise, they will acknowledge a fair and square defeat in a tussle between themselves and a community, and retire as gracefully as they can from any further operations in the same direction.

An American Naphthalene Inquiry.

When all gas engineers are in the position to adopt vertical retort plant, or heavy charge working in horizontal retorts, there will be, with the ordinary run of gas coals, little or no trouble from naphthalene. To this conclusion British gas engineers arrived some time since, owing to the favourable experiences of the past few years. It would seem, from a report by a Sub-Committee of the American Gas Institute on the subject of naphthalene experiences, that the naphthalene difficulty is still regarded as a "problem" across the Atlantic. At the head of the report stand the words "The "Naphthalene Problem of To-day." We had fancied that the "problem" had been practically solved; and that, in most cases nowadays, if gas engineers using high temperatures seriously suffered from naphthalene, it was largely their own fault. If their system of working was such that a troublesome quantity of naphthalene was produced, then one of the methods of oil-washing averted expensive nuisance. As a matter of fact, our American friends had arrived at the same conclusions; and therefore there is no real "problem" existing, except perhaps where there are abnormal experiences for which one still cannot account, but which point to abnormal conditions. The report suffers in its value by not giving some idea of the character of the coal used, more definite information as to the weights of charges, and the dimensions or the cubical capacity of the retorts, so as to ascertain, in respect of the last two, their relation. However, the investigation largely confirms experience on this side, that, despite the degree of temperature, there is more or less relief from the naphthalene trouble according to the modern system or practice adopted in carbonization.

Early in the report, we get a comparison (without information as to the coal used) regarding the naphthalene found per 1000 cubic feet of crude gas from three systems of carbonization, and in two of the cases in the tar. The figures are rather interesting. Per 1000 cubic feet of the crude gas from the vertical retorts, the average naphthalene content was 204 grains; from horizontal (short) retorts, 926 grains; and from chamber oven plant, 163 grains. The chamber oven gas came out the best, due no doubt to the comparatively low temperature at which carbonization proceeds; but the tar contained no less than 4·239 lbs. of naphthalene (or 29,673 grains) per ton of coal carbonized. The vertical retort plant gas only contained 41 grains more per 1000 cubic feet (or 204 grains) than the gas from the coke-oven plant; while in the tar only 375 grains were found per ton of coal carbonized. The value of the figures for comparative purposes is depreciated by the absence of information as to the character of the coals and specific particulars as to the quantity and quality of the gas produced. The figures, however, indicate sufficiently clearly that, while temperature plays, *ceteris paribus*, an important part in the production of naphthalene, its bad effects in this direction are largely prevented by a modern system of carbonization. The reporters point out that, in coke plant working up to 1200° Fahr., no naphthalene was produced—at least none was observed; but during the lean period of gas production, the temperature was raised to 1500° Fahr. Naphthalene was then made; and it is considered that naphthalene being produced at this temperature is evidence that it is certainly made at higher heats in other plant. But it is not evidence (there appears to have been little exact measurement in connection with the coke-oven plant) of naphthalene production proportionate with the rise of temperature; the figures already quoted showing that the system of carbonization itself has its effect. The vertical retorts (which there is no doubt were being worked at several hundred degrees higher temperature than the coke-oven plant at its highest temperature) only produced a comparatively few grains more naphthalene in the crude gas, and had a very low content in the tar—this tar being excellent for use in a washer as an extractor of naphthalene. But the tars from the inclines and horizontals were very rich in naphthalene; putting the coke-oven tar altogether in the shade with 7·62 lbs. and 9·1 lbs. per ton of coal carbonized. The whole report confirms that upon the method of carbonizing rather than upon temperature depends the degree of naphthalene in the gas. Where light charges are used in horizontal retorts, the trouble is very pronounced. In heavily charged retorts, the production is greatly diminished, notwithstanding the use of higher temperatures. This is the chief lesson of the report; and it is suggestive of the course to follow, apart from all other considerations, in constructing new carbonizing plant—plant not necessarily of the vertical type.

With the adoption of modern methods of carbonization, there is greater economy in the subsequent operations; little, if any, consideration having to be given to the question of using special washers for naphthalene purposes. In America, water-gas tar is largely employed for naphthalene extraction; but, of course, all water-gas tars are not suitable, particularly when the superheater of the water-gas plant is run at a high temperature. There is also found a variety of practice in regard to the temperatures at which the naphthalene washers are run; and there again is uneconomy, as it follows that with high temperatures a larger capacity and a larger quantity of solvent are required per unit of gas of a given naphthalene content. It would be interesting to have an investigation made of one of the works, to ascertain why it is there are no naphthalene disturbances in the district, although the mixed gas leaving the works contained an average of 282 grains of naphthalene. The probability of this being due to the mixture containing four-fifths of water gas, and this gas no doubt what in this country we should regard as a rich one, is in all likelihood the proper explanation.

Plans have now been deposited in the Private Bill Office for Private Bills and Provisional Orders which will come before Parliament during next session. The plans number 191, against 193 last year.

ALBERT WEISS, OF ZURICH.

It is with much regret that we have to report that the death occurred suddenly on Tuesday last of Herr Albert Weiss, the Engineer and Manager of the gas undertaking of the Corporation of Zurich. Herr Weiss, who was still in the prime of life, fell a victim to an attack of appendicitis. He had held the position of Manager of the Zurich Gas-Works for seventeen years, and was mainly responsible for the design and construction of the works at Schlieren, which superseded the older works of the Corporation, and greatly attracted the attention of gas engineers at the time of their completion in 1898-9, on account of the originality of design, the completeness of the mechanical equipment, and the extensive use of electrical power. A full translation of a description of these works from the pen of Herr Weiss was given in the "Journal" in 1901 (Vol. LXXVII.), and was republished as a *brochure*. Considerable extensions have taken place since that date, under Herr Weiss's direction; and the equipment of the works at the present day is one which excites the admiration of gas engineers from all parts of the world.

Herr Weiss was well-known to a very large circle of gas engineers of all nationalities. He was a regular attendant at the annual meetings of the German Association of Gas and Water Engineers, and was also frequently present at the meetings of the French and Austrian Associations. At the time of his death he was President of the Swiss Association of Gas and Water Engineers. He took a great interest in the work of the International Photometric Committee, now merged in the International Illumination Commission; and at the three meetings of the Committee which were held at Zurich he was largely responsible for the cordial reception of the delegates, and the excellent arrangements made for the conduct of the proceedings. He was present, as one of the representatives of Switzerland, at the gathering in Berlin in August last, at which the International Illumination Commission was evolved, and was elected Honorary Treasurer of the Commission.

Referring to the death of Herr Weiss, our contemporary, the "Journal für Gasbeleuchtung," wrote last week: "The news will fill with deep sorrow a wide circle of our industry, as the deceased gentleman was in its very front ranks, and enjoyed the affection and esteem of a large number of friends."

PERSONAL.

Mr. W. P. Gibbons, of Messrs. Gibbons Bros., Limited, of Dudley, has accepted the Chairmanship of Section I. of the Society of British Gas Industries, in place of the late Mr. J. Armitage Drake, J.P.

At a meeting of the Belfast City and District Water Commissioners last Thursday, Mr. S. Rea mentioned the gratification with which the members had heard of the election of the Commissioners' Engineer, Mr. F. W. M'Cullough, J.P., as Vice-President of the Institution of Water Engineers—an honour which he said was greatly coveted, and was a signal recognition of merit.

Mr. Daniel S. Munn, Chief Assistant at the Dawsholm station of the Glasgow Corporation Gas Department, has been unanimously appointed Gas Manager by the Renfrew Town Council. Mr. Munn has been upwards of twenty years with the Glasgow Corporation, and for the past three months has been filling the position of Manager at Renfrew, owing to the illness of Mr. Lighbody, who has now resigned.

Mr. Thomas Cole, Assoc.M.Inst.C.E., who will be remembered by some of our readers as the Secretary of the first Institution of Gas Engineers, has relinquished the position of Secretary of the Institution of Municipal and County Engineers, which he has held for twenty-three years. We learn that, in recognition of his long and valued services, the Council have appointed him Consulting Secretary at a salary.

At the monthly meeting of the Works Committee of the Ashton and District Joint Water Board last Thursday, a letter was read from Mr. Edward Davenport, Manager of the Swineshaw Valley Water-Works, resigning his position after holding it for a period extending over thirty-three years. A resolution was passed accepting the resignation with regret, and expressing the Committee's appreciation of the faithful and valuable services rendered by Mr. Davenport during his long connection with them. The Chairman (Alderman Fentem) mentioned that Mr. Davenport had been connected with the water undertaking for something like sixty years, and had always displayed great interest in everything connected with it.

The Christmas number of the American "Gas Institute News" contains some particulars in regard to the new President—Mr. W. H. Gartley. He was educated in the public schools, Norristown, Pennsylvania, and graduated in the Pennsylvania Polytechnic College in 1876. He went through the one-year postgraduate course at the Cornell University; was a graduate of the United States Naval Academy in the Engineering Corps in 1881; and was ordered to U.S.S. *Essex*, cruising along the west coast of Africa and the east and west coasts of South America. He resigned from the Navy in 1884. Mr. Gartley's connection with the gas industry commenced with Professor T. S. C. Lowe in 1884-85. From the last-named year till 1889 he was Engineer of the National Gaslight and Fuel Company, of Chicago (Ill.); from 1889 to 1897, Engineer of the Philadelphia Gas Improvement Company; and from the latter year onwards, Engineer of the Philadelphia Gas-Works. He was Chairman of the Technical Committee of the Institute in 1908 and First Vice-President of the Institute in 1909—being in the same year President of the Illuminating Engineering Society.

ELECTRICITY SUPPLY MEMORANDA.

Electricity has been of late rather frequently certifying its weaknesses, by quite a crop of failures of supply, and occasional fires. Some recent fires, where the causes have been reported as unknown, have arisen in places where electric light and electric motors are in use; but it is generally suspected that a spark from—Heaven only knows where, or a lighted match that was not required for lighting with electric switches handy, has caused the outbreak, possibly hours after all who had been at work on the premises had been safely established in their homes, or anyway ought to have been. In view of these obscure incidents, chiefs of fire brigades and of insurance offices should make a study of such breezy reading as the recent deliverances on "Pressure Rises" and "Insulation Resistances." They might throw light on, and give leading as to, some of the mysterious conflagration events so frequently chronicled nowadays—at any rate, they might open the way to far more discovery than seems possible through a lack of knowledge or inquisitiveness on the part of people whose business it should be to know of these things. There is one thing the electrical people cannot do, and that is to hide a failure of the supply. As already said, there have been several of these events, which help to create diversity in the household, in factories, and in street where the incomparable for unreliability has received installation. The city of Monmouth has lately been very much agitated over failures of the electricity supply; and on Sunday, Nov. 30, the culminating point in a chain of disconcerting electrical events was reached. There was then a very complete cessation of supply; and that evening and the following days trustful householders and factory owners had cause to regret their choice of lighting and power agents. Houses, shops, and streets, to the extent of electrical patronage were left in darkness during the evenings and night; motors were standing idle during the days; and workers dependent on the latter were unable to continue their occupations. The churches and chapels on the Sunday evening with gas equipment were able to hold their services. The "Beacon," which sheds light upon local matters in Monmouthshire, in its issue on the following Friday was very wrath over the whole business; and, as its printing machinery is driven by electrical energy, it threatened that if a breakdown occurred on one of its publishing days, it would claim heavy damages from the Corporation. The "Beacon" does not know the law. It does not know that the law is very lenient to electricity supply in regard to its weakness, and that, while an insignificant penalty might be inflicted on the Corporation, its chances of obtaining damages would be very remote. However, it is not our business to prevent our lawyer friends from pocketing a fee for advising the "Beacon" in this matter; but it is rather an uncomfortable reflection that great loss may be occasioned by cessation of the supply of electrical energy, with little likelihood of obtaining compensation. The distribution system of Monmouth seems to be in a deplorable state of decay; and the Corporation have been losing increasing quantities of current through those films of moisture on the interior and exterior of the insulation about which we heard in the recent paper, before the Institution of Electrical Engineers, on insulation resistance. The Corporation are roundly reproached for not having set their distribution system in thorough order before the present position had been reached. It is feared that a big expense in doing the work will now have to be incurred.

Avoidable Loss and Inconvenience.

The Two Meters.

We have come across a freshly developed estate not a hundred miles from London, new residents upon which are urged by the estate agent to adopt electric light. The houses are only of a rental of about £40 a year; and the people who occupy such houses, as a rule, have fixed and somewhat limited incomes, and so little to waste. They enter upon the new tenancy with a desire to be equal to their neighbours in every way; and, in their ignorance, they consent to the installation of the electric light. In their former habitations, they have been accustomed to have the enjoyment of one or more gas-fires in winter, to have the advantage of a gas-cooker all the year round, and some of them have had the comfort of a gas water-heater. In their new residences, discontent is emerging from the happiness that reigned in the early part of their tenancy. The gas bills of two or three of the residents of whom we have heard are nearly as much as when, in their former houses, they used gas for light as well as for other domestic services; and this is showing them how small was the lighting part of their gas bill in those days. The gas and electric bills combined amount to more than did the old gas bills for corresponding periods; but a very real trouble is that there are now

two accounts for which to provide, and there are now two meter-rents to pay, and there is the trouble of the double collection. In room and water heating and cooking, electricity does not offer the same facilities and value to these people, so that they cannot look in that direction for relief in the shape of a single account. Now that the novelty of electric lighting has worn off, and the glare of unshielded metallic filaments causes aching eyes, there are some of these people who are sorry that they were misled by a passing fancy, and a persuasive agent, into having two meters installed—the one which could be best done without being the electrical one. "One meter, one lighting, heating, cooking, and hot-water supply agent, and one account" should make a very good advertisement line for gas undertakings.

Discontented Electric-Cooker Users.

We have had related to us on several occasions incidents referring to the reinstallation of gas-cookers where electric-cookers have had a transient existence. Some of the incidents are rather amusing; but it is not our business, nor should we deem it fair play, to make specific use of them. We are not in the habit of trespassing upon the domain of the private individual, and making capital by the disclosure of names or other means of identification. Some of the incidents, however, suggest that all electrical concerns have not up to the present found this cooking business very remunerative. There is rather a large capital expenditure to be incurred per consumer; and the rents charged by some undertakings for the electric cooking appliances are insufficient to meet all the charges—capital and those incidental to endeavouring, by inspection and repair, to promote their good behaviour. But there is a much more disconcerting phase of this business—not for us, but for the suppliers of electricity. The other week one of the electrical papers was upbraiding the makers of electric-cookers for their deficiencies, which were causing trouble between local electricity suppliers and their customers for cooking. More than one instance has come under notice in which a dissatisfied user of an electric-cooker has had it changed for one of another type; and the next move has been in a recent case within knowledge, and is likely to be in another, back to a gas-cooker. The first electric-cooker in one of these instances was of a type that cost upwards of £10, without fixing; and it has been replaced by another type which cost rather more, simply because the user could not put up with the idiosyncrasies of the first cooker, which may be palmed off on to another householder who is transiently fascinated by the idea of cooking electrically. But meanwhile, the electricity undertaking has incurred considerable expense in trying to meet the requirements of the householder in question; and the fate of the electric cooker No. 2 hangs in the balance. The undertaking cannot be making much profit from the penny per unit consumption of this customer. Many more similar ones would make the cooking load something the undertaking could well do without, especially in a place where much of the cooking synchronizes with the lighting load peak.

Hazy Information.

"Hazell's Annual" for 1914 has reached us for review, accompanied by a few prompting notes for use to save the reviewer an amount of trouble. Among the notes we observe this statement: "'Unvarnished facts' is evidently the motto of the Editor of 'Hazell's Annual,' and an excellent motto it is for a work whose value depends upon its trustworthiness." We have not time to, and it is not expected that we should, wade through the whole of the annual to test whether or not the facts are unvarnished; but our eyes happen to alight on a section devoted to "Electric Supply," concerning which "Hazell's Annual" is about the last place in which it would have occurred to us to look for information. Two or three of the facts in the section appear to have rather a thick coating of varnish over them; and really we do not know why, in a volume of this kind, anyone should go out of his way to prejudice one industry by stating something in regard to another that is not in accord with fact. This is one of the paragraphs of which we can justly make complaint, and which is allied through every feature to the literature with which electricity-supply concerns seek to develop business among householders:

> There can be little doubt that electric cooking ultimately will supplant all other methods on account of its obvious inherent advantages, It is clean, convenient, simple, and absolutely uniform in its results. while it costs no more than gas, provided current can be obtained at 1d. or less per unit. A material saving is effected in the shrinkage of meat cooked electrically, average results showing a loss of no more than 10 per cent., compared with 25 to 40 per cent. with gas or coal.

These are unfair statements; and the Editor of "Hazell's Annual" has undoubtedly been "had." But the Editor is the responsible party; and, having made an allegation, perhaps he will settle down and tell us, in order that we may discuss the matter with him, why he thinks there can be little doubt that electric cooking will supplant all other methods, seeing that gas is "clean, convenient, simple, and," in the hands of anyone after a very brief experience, "absolutely uniform in its results." The gas equipment, too, costs much less than the electric equipment, it is exquisitely simple, and there is nothing to get out of order, except the cooker is subject to neglect, and, of course, there is the deterioration of a long and strenuous life. The electric cooking equipment is the reverse of all this; and the seats of failure about it are many. There is the point as to cost. It is a simple matter to be dogmatic. We should like the Editor of "Hazell's Annual" to show us his proof that cooking—comprising baking, boiling, frying, stewing, and so forth—will cost less than gas with electricity at 1d. per unit. Gas may be taken at 2s. 6d. for comparison. Then as to the shrinkage question. This is an old piece of electrical fiction. The Editor of these "unvarnished facts" is, of course, not aware that our electrical friends consistently decline all challenges to publicly put this point to test, nor will they append their names to any rational reply to this question: Why, cooking meat as it should be cooked in a gas-oven, using temperatures equal to the electric-oven, and subjecting the meat to these temperatures for the same length of time, should there be 15 to 30 per cent. more shrinkage of a joint in the gas-oven than in an electric-oven? There is more in the same article that could be criticized; but we will be content if the Editor of the volume before us will justify in our columns the (so-called) "unvarnished facts" to which we have called attention. The index tells us that on p. 458 there are some comparative gas plant statistics. We fail to find there sufficient justification for the index statement. The Editor appears to have overlooked the fact that there are some interesting statistics referring to the gas industry in existence, as well as information upon such subjects as failures, fires, intrinsic brilliancy of lights, and a score of other matters referring to electricity, about which reliable informants within our knowledge could supply him with excellent popular material.

A Half-Watter for High Voltages.

Siemens Bros. promise the electrical industry that, early in the new year, they will place on the market a ½-watt lamp for voltages ranging from 50 to 230. If recollection serves correctly, this is the first lamp of the ½-watt metal filament type that has claimed to work obediently on the ordinary voltages; other claimants to the high efficiency of a candle per ½-watt only professed capability, as they first came over the horizon, of being worked in series on the ordinary voltages in the same way as the modern arc lamps. The new lamp has been seen, and reported upon, by our electrical contemporaries. It has a spiral tungsten filament; and the bulb contains, as its predecessors, a charge of inert gas, at (it is stated) a pressure of 9 lbs. per square inch. We are not told whether the glass is thicker than the glass of the ordinary electric lamp bulb. But anyway if a bulb gets cracked, it may be that the 9 lbs. pressure per square inch will give a good account of itself. We do not know with certainty quite what would be the result, as we have never tried cracking a bulb with inert gas in it under that pressure, and with a high temperature incandescent wire inside. Another feature of the lamp is that the bulb is surmounted by a long neck, into which, if they do not take the wrong turning, any particles set free from the filament under the action of high temperature will pass, so as to prevent the blackening of the bulb at its light-giving part. The lamps are being made in 300, 500, 1000, and 1500 watt sizes, which figures may be multiplied by two to arrive at the reputed candle power. The makers state that the lamps should be useful for indirect and semi-indirect systems, or for competition with arc lamps. The suggestion as to the shielding of the lamps by the adoption of an indirect or semi-indirect method is very necessary; for, bad as is the ordinary metallic lamp in the matter of intrinsic brilliancy, this drawback will be intensified many times in the new lamp. As to the suggestion that the lamp should compete with the flame arc lamps, with an efficiency of 3 to 4 candles per watt, the arc lamp makers will try to present a good case in opposition, despite the cost of carboning and attention that the arc lamp involves. It will be interesting to see what they will have to say on the subject.

An Indifferent Electricity Advertisement.

The "Electrician," while admitting that the manufacturers of the new lamp are justified in making its merits widely known, do not think it is necessary for them to achieve this end at the expense of so "valuable" a lighting agent as the flame arc lamp. It adds: "We would far rather see a lamp of this type introduced for side street lighting in place of the small 80 and 100 watt 'lanterns' which now afford but an indifferent advertisement for electricity." We agree. "Similarly," we proceed to read, "the new high voltage ½-watt lamp may be looked upon as a powerful competitor of high-pressure gas for shop lighting." The new lamp has a lower efficiency than flame arc lamps; and arc lamps have had a bad time in many shopping centres through the favour in which the high-pressure gas-lamp is held, with its constancy, economy, and good quality light. So we are thinking it will, all things considered, hold its own quite comfortably under the new competitive conditions—not only on the grounds named, but because shopkeepers will not find it an advantage to drive people from their windows by an intolerable glare. However, in this sphere, our contemporary thinks, the advantages of the lamp should be pressed home. Then follows a little sage advice upon which we will not comment, as it appears to be somewhat mixed. It reads: "Electrical contractors and central-station engineers should co-operate in any district in which high-pressure mains for shop lighting have been actually laid down or contemplated. A progressive policy such as this will help to maintain those sections of the electrical industry in a flourishing condition, and will assist them to reap the reward of many years of labour. We refer in particular to the arc lamp makers."

THE FUNNY MAN AND STERILIZATION.

THE "M.O.H." from whose desk emanate a few columns, headed the Public Health Department, in "Sanitary Record and Municipal Engineering," will not expect anyone to take his writings seriously in future, for in last week's issue of the paper there is an editorial pronouncement which indicates that he is regarded merely as the funny man of the staff. His response to our recent demonstration of the value of the incandescent gas-burner as a sterilizer will be read, his superior believes, "with considerable amusement." The editorial belief in the amusing qualities of his response has been justified in the sensations which it has caused us; but surely it was a little unkind of his Editor to be so candid in thus disclosing the rôle of "M.O.H."! The latter thinks we are rather rude and personal; but, after this example of editorial candour, he will rather be praying to be saved from his friends nearer home.

Editorial unkindness does not even end with the remark we have quoted—for "M.O.H." is allowed to take the responsibility for so obviously biassed a statement as: "At the present time in the lighting line, there is only one agent that attends strictly to business, and that is electricity;" while two pages earlier the Editor speaks of "the acknowledged advantage of gas as an illuminant." The entire detachment of "M.O.H." from editorial sympathy is obvious; and we are not greatly surprised. But surely editorial supervision was lax when it allowed him to jibe at the full name of the "JOURNAL" as "clumsy," what time the title of the paper in which he writes is longer than ours! We are amused that even the funny man of the staff has such a measure of tolerance extended to him.

The amusement with which, in the belief of his Editor, the response of "M.O.H." will be read, is in no small degree caused by the fact that he writes very angrily, because he has now to admit that the incandescent gas-burner has a sterilizing effect. He admits it grudgingly, and seeks to minimize the effect. But when he wrote on the matter previously, he could not understand how the gas-burner could have any such action, and asked for information. We pointed out that if he were competent to write on gas topics with the authority which he assumes, he should not have had to ask for the information, but should have had it at command. He had said, however, that he was prepared to be convinced if sufficient proof of Mr. Charles Carpenter's assertion as to the advantage as a sterilizer of the bunsen flame used in incandescent gas lighting were forthcoming. In good faith we supplied him with proof, which he accepts, though in a grudging and ungracious manner. He seeks to minimize the sterilizing effect of the incandescent gas-burner, and says that, "from the sterilization point of view, the incandescent light is not nearly so good as a fish-tail light or even a candle." Here is a definite statement, the truth of which we challenge him to prove. We do not consider a mere statement of opinion as proof—we ask for experimental data which should be obtainable without difficulty by one who is said to be well able to criticize from *the bacteriological and chemical point of view* a statement as to the sterilization of the air of rooms by incandescent gas-burners. We suggest that he should state how many cubic feet of air are raised to a sterilizing temperature by, firstly, a candle, and, secondly, an incandescent gas-burner of some widely-used pattern. His statement is one which is susceptible of proof, and we throw on him the *onus* of proving it without delay. The alternative before him is its entire withdrawal.

"M.O.H." makes many wild statements regarding gas, mostly based on mere expressions of opinion, which are worth little unless backed by facts and data. The statement we have quoted is perfectly definite; and we, in common with the other readers whom he amuses, have a right to know from him on what it is based. The other statements by which he now seeks to disparage gas as an illuminant and at the same time to cover his defeat on the original issue as to whether the incandescent gas-burner has a sterilizing action on the air of rooms are really calculated only to amuse.

INCREASING COKE SALES.

A Manchester Conference.

ON the 1st of this month, a conference, presided over by Mr. Edward Allen, was held at the Institution Offices in Victoria Street, to which were invited representatives of the gas-works (principally in the Midlands) which are in the habit of supplying coke to the London market; and during the proceedings great stress was laid by the speakers on the necessity of undertakings endeavouring to find fresh uses for coke in their own particular districts. In securing new outlets, managers should derive substantial assistance from the Coke Committee of the British Commercial Gas Association (the formation of which was announced by Mr. Allen in the course of his Presidential Address at the recent conference). According to the "Bulletin" of the Association for December, this Special Sub-Committee (whose object is "to consider ways and means for increasing the sale of coke") are taking steps to collect and collate information as to methods that have been already adopted by members for furthering the sale of coke in their districts. The Committee consists of the President of the Association, the Chairman of Executive, and Messrs. Edward Allen, J. W. Auchterlonie, J. Ferguson Bell, A. E. Broadberry, G. Clarry, R. S. Hilton, Alderman F. S. Phillips, H. Pooley, E. E. Rudge (Secretary of the London Coke Committee), W. W. Topley, Thomas Waddom, D. Milne Watson (Chairman of the London Coke Committee), Robert Watson, W. N. Westlake, and Alexander Wilson.

At the request of members from the North, it was decided by the General Committee of the British Commercial Gas Association to summon a conference of all interested in coke in the Midlands and North of England. This took place in Manchester last Tuesday afternoon, when (through the influence of Councillor Kay, the Chairman of the Manchester Gas Committee) the Lord Mayor's Parlour was placed by the Corporation at the disposal of the large number of delegates who attended. The proceedings were private; but we learn from Mr. W. M. Mason (the Secretary of the Association) that an interesting discussion on the general question of coke disposal took place and that many practical suggestions were made, which will undoubtedly be beneficial in stimulating sales and in encouraging managers to develop local methods of disposal. A very striking instance of the value of good advertising was mentioned; the manager of one of the largest undertakings in Yorkshire stating that, by his local publicity efforts, he was now in the happy position of receiving more orders than he could conveniently handle.

The main causes of the difficulty in disposing of stock were traced to unnecessary "dumping," indiscriminate and "panic" sales, and lack of information or neglect to use the information which is available. The remedies suggested included advertising (general and local); co-operation with District Commercial Sections; adoption of friendly interchange of local facts and figures, instead of blind competition; the development of local markets, especially in domestic directions; the avoidance of long contracts; and direct dealings with users, instead of through large agents and middlemen.

THE PHYSICAL SOCIETY'S EXHIBITION.

A VERY interesting collection of electrical, optical, and physical apparatus was on view at the ninth annual exhibition of the Physical Society, which was held at the Imperial College of Science, South Kensington, last Tuesday. There was not much, however, that was very closely associated with the gas industry, except at the stand of Messrs. Townson and Mercer, who showed Hornby's, Somerville's, and other apparatus for testing gas, &c. Messrs. A. Gallenkamp and Co. exhibited a Berthelot-Mahler bomb calorimeter and a Fischer gas calorimeter, together with apparatus of general scientific interest. Professor J. T. Morris and Mr. J. F. Forrest demonstrated their arrangement for utilizing the electric arc as a standard of light. Three carbons are arranged in the form of a "Y" in a horizontal plane. At the junction of the carbons an arc is struck; the vertical leg of the "Y" being positive, while the two sloping parts are negative. The positive crater is thus unobstructed, and an accurately gauged diaphragm is placed in front. It is found that, with a silent arc, an intensity of 162 candles per square millimetre is obtained.

At the stand of the Cambridge Scientific Instrument Company there was a set of micrometers intended for measuring the relative movements of a building on opposite sides of a crack. Three micrometers are provided which separately measure the movement in three directions at right angles. Dr. W. Watson, F.R.S., gave demonstrations with an indicator suitable for use with high-speed internal-combustion engines. They had been used in a series of experiments on the efficiency of four-cycle and two-cycle engines, and on internal pressures at various speeds and admissions. He also showed and explained an arrangement for studying the spectrum of a burning explosive mixture at different stages of combustion. It consists of an engine having a cylinder fitted with a quartz window through which the flames of the coil sparks are observed.

As many gas managers now use motor-cars, it will be of interest to mention a demonstration by Mr. Clifford C. Paterson and Mr. B. P. Dudding, of the National Physical Laboratory, of a device for mitigating the dazzle caused by headlights. Their proposal is to prevent the emission of any light from a headlight to the right-hand side of the road and above the horizontal. A semi-circular screen is placed in front of the lamp, and a smaller one (a quadrant) behind it in the focus of the mirror. Full light is left over the whole width of the road below the horizontal, and also above it on the left-hand side seen from the car. Drivers of vehicles or pedestrians coming towards the car on their own side of the road are thus illuminated to a height of 3 or 4 feet from the ground, while no direct or directly reflected light meets the eyes of such persons, and hence no discomfort due to dazzle is experienced by them.

There are about 200 plants for the manufacture of gasolene from natural gas in the United States, many working on as little as 125,000 cubic feet of gas per 24 hours. The residual gas, after the removal of the condensable portion, has a high calorific value, unless it be diluted with air owing to leakage during the process. Some residual gases have been found to contain from 40 to 50 per cent. of air.

THE LIGHTING AND WATCHING ACT.

Rural District Council Accounts.

THERE has been issued as a Blue-Book Part III. of the Annual Local Taxation Returns for the year 1911-12. This comprises abstracts and returns made by Rural District Councils, Parish Councils, Parish Meetings, Joint Committees appointed wholly by Parish Councils and Parish Meetings, and likewise by Inspectors and Committees under the Lighting and Watching Act, 1833.

There were at the commencement of the year beginning on April 1, 1911, 655 rural district councils in England and Wales; and their receipts (exclusive of borrowed money) amounted in the aggregate to £4,925,505. Of this, £3,507,427 was from rates, and £351,347 from grants under the Agricultural Rates Act. From water-works there was a revenue of £213,507; and the balance was made up of various other items. A sum of £1140 was received from gas-works, and £2714 from an electric light undertaking. The total receipts, compared with the previous year, show an increase of £161,389. The expenditure not defrayed out of loans amounted to £4,859,402, which was an increase of £45,951 compared with the preceding twelve months. The expenditure on water-works was £207,228; on gas-works £1224; on electric lighting (excluding the cost of public electric lighting) £2659. The sum expended on public lighting was: Electric lighting, £3015; other lighting, £23,660.

The receipts from loans in the year 1911-12 totalled £582,871, of which £228,000 was for water-works purposes; and the expenditure out of loans was £564,690, of which £205,836 was for water-works, and £3561 for electric lighting. The total outstanding loans on March 31, 1912, were £6,301,940; the figures for water-works being £1,968,131, for electric lighting £35,228, for gas-works £2887, and for public lighting £451. The outstanding loans have increased by 7·4 per cent. during the period from 1907-8 to 1911-12. The assessable value of districts for the purposes of the Agricultural Rates Act, on which contributions towards general expenses were payable, was £45,550,301; and for special expenses of contributory places in which rates for such expenses were levied, £23,764,897. The population of the districts, according to the census of 1911, was 7,826,555. The loan charges, for interest and for repayment of capital, were £527,341.

There were during the year ended March, 1912, 7238 rural parishes entitled to parish councils, and 5660 other rural parishes; but only 6405 parish councils had financial transactions in the twelve months, and 403 parish meetings. Rates to meet general expenses were raised for 3611 parish councils, and for the parish meetings of 148 parishes not having parish councils. Under the Lighting and Watching Act, 1833, rates were raised for 936 parish councils and seven parish meetings. The actual number of parish councils having transactions under the Act was 1013. The total receipts under the Act were £89,630; and the expenditure, including loan charges, was £88,482. In 25 parishes or lighting districts the Act was administered by inspectors or joint committees; and in these cases the receipts amounted to £2605, and the expenditure to £2588—in addition to the amounts already mentioned. The rates raised under the Act by parish councils or parish meetings, in respect of buildings or other hereditaments not being agricultural land, amounted to 3d. or under in the pound in 580 cases, over 3d. but not more than 9d. in 351 cases, and more than 9d. in five cases.

The total amount of the loans outstanding at the end of the year under review, for the councils and the parish meetings, was £237,851, of which £859 was for public lighting other than electric lighting, and £491 was for public electric lighting. Of the 25 parishes or lighting districts in which the Lighting and Watching Act was administered by inspectors or by joint committees, in nineteen cases lighting inspectors were appointed under the Act, while in the remaining six there were joint committees appointed under the Local Government Act of 1894, to exercise the powers of lighting inspectors in areas comprised in more than one rural parish. The lighting rates made during the year in respect of houses, buildings, &c., in these districts, varied from 1½d. to 9d. in the pound; the rates levied in respect of land being in all cases one-third as much. If the amounts involved in these districts are added to the sums received and paid under the Act during the year by parish councils and parish meetings, the total rates raised in 965 rural parishes amounted to £89,988, the total receipts to £91,683, and the total expenditure to £90,518.

Wooden Water-Pipes.—The following appeared under the heading of "Trade Chat" in a recent number of the "Ironmonger:" "Water-pipes of wood are now regarded in this country as something of a curiosity, and as relics of a bygone age; but, curiously enough, their manufacture is being carried on commercially in Canada, and their use strongly recommended in situations and for purposes where metal pipes are found to be unsuitable or objectionable. This return to old-time practice looks at first like a retrograde step; but there seems to be some reason for the substitution of wood for iron or steel in certain cases, owing to the fact that wooden pipes are not affected by frost, corrosion, electricity, or acids. The pipes are strengthened by having galvanized wire wound tightly round the outside, and are said to be able to withstand a working pressure of 250 lbs.

WATER LEGISLATION FOR 1913.

[THIRD ARTICLE.]

THE Metropolitan Water Board have obtained an Act empowering them to construct works, acquire lands, and make further provision for the supply of water. The works comprise a service reservoir in the parish of Eltham, two others in the parish of Westerham, and thirteen aqueducts, conduits, or pipe-lines; a wharf or landing-stage on the northern bank of the Thames at Hampton, and six lines of railway in connection therewith. Fifteen years are granted for the completion of the reservoirs and aqueducts, and five for the wharf and landing-stage; and the Act contains general provisions for the protection of gas, water, and electricity mains and sewers while they are being carried out. The Board on the one hand and the Conservators of the River Thames, or any company, body, authority, or person, on the other, may enter into and carry into effect agreements and arrangements with respect to the construction, maintenance, and user of the wharf or landing-stage, and the works connected therewith or incidental thereto. Power is given to acquire certain lands at Hanworth and Sunbury for the purpose of making filter-beds, and others in the parish of Camberwell for the existing Rock Hill reservoir. The limit of time for the compulsory purchase of lands or easements for the construction of one of the aqueducts specified is seven years from the passing of the Act; for the purposes of the wharf or landing-stage, three years; and for other purposes, five years. Powers already granted for the construction of works and the acquisition of lands are to be revived; and the Board have been granted an extension till July 20, 1928, of the time limited by the East London Water-Works Act of 1900 and the Board's Act of 1906 for making a reservoir, and till seven years from the passing of the Act for the completion of certain conduits or pipe-lines sanctioned by the first-named Act. The Board may borrow £456,000 for the construction of reservoirs and filter-beds and the diversion of streams; for the construction of the railways, the wharf or landing-stage, the aqueducts, and the works for which the powers are revived, £620,000; for the provision of locomotives, rolling-stock, &c., in connection with the railways already mentioned, £180,000; and other moneys, of which the amounts are not specified, for the purposes indicated in the Act. For the repayment of the two first-named sums, sixty and fifty years are allowed; for the third, twenty years. The provisions of the Board's Acts of 1902 and 1906 are to apply to the moneys authorized to be borrowed under the Act and the repayment thereof. The Act contains a new section dealing with the Board's deficiency in respect of certain years. The sum of £209,572 13s. 3d., the aggregate amount of the deficiencies for the four years ended March 31, 1912, is to be deemed a sum required to meet a deficiency in the water fund within the meaning of section 15 of the Metropolis Water Act, 1902; and the section is to apply and have effect accordingly in relation to the amount named. For the purposes of the new section, the expression "the preceding sixth day of April" in section 15 is to be construed as meaning the sixth of April, 1912. Any precept issued by the Board may require that the amount specified therein shall be paid to the Board on or before April 30, 1914, either in one sum or by such instalments as the authority to whom the precept is issued may determine. The next section empowers the Board to borrow temporarily for the purpose of meeting current expenses. [*Parliamentary Agents: Messrs. Dyson and Co.*]

In a General Powers Act obtained by the Morley Corporation, it is laid down that when water supplied for domestic purposes is used for washing horses, carriages, or motor-cars, or for other purposes in stables or premises where these are kept, the Corporation may, if a hose-pipe or other similar appliance is used, charge such additional sum, not exceeding 20s. per annum, as they may prescribe. The Corporation are empowered to increase their water-rates with the sanction of the Local Government Board; to levy on the owner instead of the occupier the water-rate in respect of property of the rateable value of £10 or less; to supply by measure, at a rate not exceeding 1s. per 1000 gallons, houses partly used for trade; and to order the closing of polluted wells. They may borrow, with the consent of the Local Government Board, such further money as may be necessary for the purposes of the water-works undertaking. [*Parliamentary Agents: Messrs. Baker and Sons.*]

Authority has been given to the Corporation of Northampton to construct additional works, and make better provision with regard to their water undertaking. The new works consist of an impounding reservoir upon the Stowe Brook, in the parishes of Guilsborough and Hollowell, a service reservoir to be constructed by the side of the existing Boughton reservoir, and three aqueducts (one of which will have a tunnel)—all to be completed within ten years. After the passing of the Act, the water limits of the Corporation will be extended so as to include the parishes of Guilsborough, Coton, and Hollowell, in the rural district of Brixworth. Water supplied for domestic purposes is not to be employed for motor vehicles or for washing them, if a hose-pipe or similar appliance is used; but the Corporation must afford such a supply by meter, so long as it would not interfere with the ordinary service. Power is granted to borrow £141,139 for the construction of the reservoirs and the purchase of lands, and £48,861 for the aqueducts—to be repaid respectively in sixty and fifty

years from the time of borrowing. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Pontypridd and Rhondda Joint Water Board have obtained power to construct four additional aqueducts in the respective parishes of Llantrisant, Llanwonno, Merthyr Tydfil, Pontypridd, and Rhondda, for the completion of which they are allowed ten years. They asked for an extension of the period specified in the Act of 1910 for carrying out certain works; and they have been given till Jan. 1, 1924. As soon as the Board shall have received a supply of water from the Corporation of Merthyr Tydfil under an agreement scheduled to the Act, certain sub-sections of section 59 of the above-named Act will be repealed, and the Board will have to deliver to the Llantrisant and Llantwit Fadre Rural District Council a minimum of 334,000 gallons, and up to a maximum of 666,000 gallons, of water per 24 hours. The charge is to be 5¾d. per 1000 gallons, subject to a reduction if the price paid by the Board to the Corporation is reduced. The Act contains provisions in regard to the rates to be charged for a supply of water for domestic purposes and its sale by measure. Section 67 of the Act of 1910 bearing on the latter subject is repealed; and the Board may charge up to 10s. per quarter in respect of water supplied by meter. Power is given to borrow £8877 for the purchase of land in connection with the works authorized, and £2226 for paying the costs incurred by the Board in opposing the Rhymney Valley Water Board Bill, 1911, and the Bill for the Merthyr Tydfil Corporation Water Act of that year. [*Parliamentary Agents: Messrs. Torr and Co.*]

An Act has been passed to authorize the transfer to the Southend Water Company of the western district water undertaking of the Rochford Rural District Council, and the extension of the Company's limits of supply so as to include a number of parishes in the rural district of Rochford in the county of Essex. The works to be transferred consist of the well, pumping-station, and water-tower at South Benfleet, and all the mains and other plant, stock, and effects of the Council in connection with their water undertaking. The consideration to be paid to the Council is £20,372 (this being the aggregate amount of the balances of the loans which have been raised, and were outstanding on March 31, 1912), and a sum equal to the actual cost to the Council of any additions to, and improvements of, the plant which they, with the approval of the Managing Director or other duly authorized officer of the Company, may have made between Nov. 12, 1912, and the date of the transfer. The Company take over the loan indebtedness of the Council, and retain so much of the purchase-money as will be required to pay off the instalments of principal as they fall due—paying the balance in cash on the date of transfer, or interest upon it at the rate of 4 per cent. per annum until the payment takes place. The Rochford, Rayleigh, and Leigh Water Order, 1891, will be repealed. [*Parliamentary Agents: Messrs. Torr and Co.*]

In an Act obtained in the session of 1912 by the Swanage Gas and Water Company, provision was made for the sale of the water portion of their undertaking to the Urban District Council, if the latter should promote, in the next available session of Parliament, a Bill to obtain authority for the purchase. This was done; and by an Act passed last session the Council have obtained authority to acquire the undertaking, on giving three months' notice to the Company. The purchase price is to be such as may be agreed upon or determined by arbitration, *plus* the expenses incurred by the Company in connection with the water portion of their Act, and those relating to the transfer and winding-up of the undertaking. The Council will purchase the movable stores of the Company, and pay compensation to any officers who may not be retained by them. The "water undertaking" of the Company means all the works, engines, mains, pipes, machinery, plant, &c., existing on the date of the transfer, with certain specified exceptions. The limits of supply are to be the parish and urban district of Swanage, and the parish of Langton Matravers, in the county of Dorset; and the rates to be charged are 8s. 8d. where the rateable value of the premises does not exceed £7 per annum; up to 7 per cent. where it does not exeeed £12 per annum; and up to 8 per cent. when it is above this figure. As soon, however, as the Council commence supplying water from the works authorized by the Company's Act of last year, the last-named charge may be increased to 10 per cent. As is now customary, there are extras for additional closets and for baths, and also for water used with a hose-pipe. The price of water supplied by measure is not to exceed 1s. 6d. per 1000 gallons. Authority is given to borrow such sums as may be necessary for the purchase of the undertaking, for defraying the expenses of the transfer, and for paying the cost of obtaining the Act; also £1000 for the supply of fittings and providing working capital. For repaying the money borrowed for the purchase, fifty years are allowed; for the £1000, ten years; for defraying the costs of the Act, five years. Provision is made for maintaining the undertaking by the Company until its transfer to the Council has been completed. [*Parliamentary Agents: Messrs. Martin and Co.*]

The brown colour of ammonium sulphate, in the preparation of which the sulphur compounds of coal gas are used, is due to iron thiocyanogen compounds. A German patent has been taken out by Herr F. Dahl for a process by which, according to an abstract of the specification in the "Journal of the Society of Chemical Industry," it can be permanently removed by treatment with a solution of nitrogen compound—ammonia or uric acid.

"SAFETY FIRST" IN GAS-WORKS PRACTICE.

[COMMUNICATED.]

IN a recent article on "Works Topics" in the "JOURNAL," it is recommended that gas-works follow the lead of the Canadian Grand Trunk Railway, and delegate to some one of their engineers the study of accident prevention. As neither the writer nor your readers may be aware that in the United States gas companies have for several years been active in this work, a brief account of some of these activities, and the causes leading to their inception, should be of interest.

The advent twenty years ago of electric street railways was soon followed by a large increase in cases of personal injury due partly to higher speed and partly to carelessness on the part of employee or injured person. Public opinion decided that the street railway companies were not only much to blame, but also quite indifferent to the welfare of other street users. This public opinion as reflected in jury verdicts quickly resulted in heavy damages against the railway companies in the majority of cases tried. This had the further effect of making it to the interest of dishonest people to claim injury where none existed, or to exaggerate minor injuries; and in this they were soon aided and encouraged by disreputable lawyers, who swarmed around accident scenes, as vultures over carrion, and agreed to prosecute damage suits in return for a percentage of the amount they were able to recover.

The street railway companies, to their dismay, found that each year the damage payments increased in a steadily ascending ratio. Very naturally, in addition to making their operation as safe as possible, their other course was to organize a claim department, the duty of which was to ascertain the facts of each accident as soon as it occurred, and, if advisable, to settle each case before a lawyer could reach the injured person and encourage a large claim. These claim departments proved their value; and it was quite natural they should become a part of the organization of other large companies, such as electric light or gas companies, whose damage cases, while nowhere near so many as those of the street railway companies, each year involved considerable sums.

Each year's round of accidents impressed more strongly on the managers of these various claim departments that, however careful the motorman might be to avoid injury to the pedestrian, or the superintendents and foremen of lighting companies to protect their workmen, yet both the pedestrian and the employee would be injured far too often unless they were educated to consider "safety first." This decision to educate each individual or class whose carelessness resulted in self-injury may be considered the second step in accident prevention; the first having been the education of the employee or foreman whose carelessness might result in injury to some one else. This second step has received a decided impetus from the natural desire on the part of all claim department employees to lessen the sorrowful sights their work entails, and from the rapidly growing feeling (clearly expressed in Workmen's Compensation Acts) that the industry and not the injured, more especially if an employee, should bear the cost of all accidents.

Among gas companies, the work of accident prevention began as early as 1906, at which time the claim department of the United Gas Improvement Company started a safety campaign, uncertainly at first, but more and more assured as the various measures proved their value. Looking back, it seems hard to believe that only ten years ago an occasional employee, and not every permanent one as now, knew how to induce artificial respiration in partially asphyxiated persons, and that then our shops and tool waggons did not contain medical and asphyxiation kits. The value of this knowledge and equipment in preventing fatalities and minimizing accidents we all know from many concrete examples. What is harder to appreciate is how much the gradual education of whole communities to "safety first" is stemming the former ever-increasing accident tide and preparing for a future ebb.

Taking the Company just mentioned as typical of many others, there is established at the head office a Safety Committee, where manufacturing and distributing engineers join with the claim department to study the lessons that may be taught by each new accident; there is a systematic inspection for existing hazards by the claim department of every gas-works shop and office; there are employees meetings to exhibit pictures of recent accidents and to emphasize the moral; there are bulletin boards to show safety mottoes and views of hazards removed through inspection; there are pamphlets embodying these words and pictures—in short, the aim is to surround the employees with a safety atmosphere, so that in course of time "safety first" will become second nature with them all.

From the larger gas companies the movement is spreading to the smaller works, and a factor in this diffusion will be the illustrated talk on Accident Prevention delivered by J. B. Douglas, of the United Gas Improvement Company, at the last meeting of the American Gas Institute. The fact that the Institute devoted an hour of its programme to the subject is a significant indication of the present-day feeling of the gas industry towards safety in operation.

TAPLAY'S COMBUSTION GAS ANALYZER.

A NEW FORM OF APPARATUS FOR COMPLETE GAS ANALYSIS.

By J. G. TAPLAY.

(*Concluded from p. 872.*)

4.—THE "ORIGINAL" GAS.

FOR the determination of the carbon and hydrogen densities of the hydrocarbons of the C_nH_m group, it is necessary to make a combustion of the "original" gas, whereby data necessary for the determination of the carbon and hydrogen densities of the mixed olefines may be obtained. At the same time, a check determination of the volume of nitrogen can be made.

A volume of the gas is drawn into the burette and read at atmospheric pressure, after which it is oxidized while the combustion tube is at a bright red heat. The residual gas is passed back to the burette, and its volume again noted. The carbon dioxide produced after the combustion is then removed, and the volume of residual nitrogen is noted. This nitrogen is then discharged, and the burette and capillaries are washed. Oxygen is then drawn into the burette and its volume noted. It is afterwards passed through the combustion-tube while the latter is at a red heat, and back again so long as any contraction in volume takes place. The residual oxygen is then returned to the burette and its volume noted. The difference between the two readings represents the volume of oxygen absorbed. To calculate the carbon and hydrogen densities, one proceeds as follows:—

	C.C.	
Volume of gas taken for combustion (say)	22·40	
Volume after combustion at a bright red heat	13·85	
Volume after passing over KOH	1·95	(= volume of nitrogen)
Volume of carbon dioxide produced after combustion	11·90	

Then, $\frac{1{\cdot}95 \times 100}{22{\cdot}4} = 8{\cdot}70$ volumes per cent. nitrogen (check test)

and $\frac{11{\cdot}90 \times 100}{22{\cdot}4} = 53{\cdot}13$ volumes per cent. of carbon dioxide.

	C.C.
Volume of oxygen taken into burette	31·70
Volume of oxygen remaining	8·60
Volume of oxygen used in re-oxidizing	23·10

Then, $\frac{23{\cdot}10 \times 100}{22{\cdot}4} = 103{\cdot}12$ volumes per cent. of oxygen.

Calculation of the Carbon Density.

Total volume of carbon dioxide	53·13 per cent.
Deduct volume per cent. of CO_2 found in the gas	2·07
	51·06
" " " CO " "	9·94
	41·12
" " " CH_4 " "	30·22
Then, 4·13 per cent. of C_nH_m hydrocarbons produce	10·90 per cent. CO_2

And $\frac{10{\cdot}90}{4{\cdot}13} = C_{2{\cdot}64}$.

Calculation of the Hydrogen Density.

Volume of oxygen absorbed	103·12 per cent.
Add volume per cent. of oxygen found in the gas	0·62
Total volume of oxygen required	103·74
Deduct oxygen required by 9·94 per cent. CO*	4·97
	98·77
" " " 44·27 " H_2	22·135
	76·635
" " " 30·22 " CH_4	60·440
Then, 4·13 per cent. of C_nH_m hydrocarbons require	16·195 per cent. O_2
Deduct volume of oxygen* required to produce the CO_2 after the combustion of the C_nH_m hydrocarbons	10·900
Then, the oxygen required to produce the OH_2 after the combustion of the C_nH_m hydrocarbons is	5·295

And $\left(\frac{5{\cdot}295}{4{\cdot}13}\right) \times 4 = H_{5{\cdot}12}$.

Here, $C_nH_m = C_{2{\cdot}64}\,H_{5{\cdot}12}$

If m = 2n, C_nH_m will be $C_{2{\cdot}64}\,H_{5{\cdot}28}$.

The hydrogen density of these mixed olefines can therefore be taken as approximately twice that of their carbon density; and if this latter be taken as sufficient for the determination of their average composition, there will be no necessity for the oxidizing material to be fully oxidized before and after the combustion.

* The oxygen required to form the carbon dioxide is equivalent to the volume of the carbon dioxide produced.

Therefore, a special measurement of the oxygen is not needed. The complete analysis, with heating values, is given below :—

Constituents.	—	Volume per Cent.	Heating Value per Cubic Foot	
			B.Th.U.	Calories.
Carbon dioxide	CO_2	2·07		
Olefines	$C_{2{\cdot}64}H_{5{\cdot}12}$	4·13	Gross.	Gross.
Oxygen	O_2	0·62	573	144·4
Carbon monoxide	CO	9·94		
Hydrogen	H_2	44·27	Net.	Net.
Methane	CH_4	30·22	511	128·8
Nitrogen	N_2	8·75		
Total	—	100·00	—	—

[For the table of heating values of different gases, and method of calculating the gross and net values from the figures obtained by an analysis, see the writer's previous article in the "JOURNAL," Vol. CXVIII., p. 287.]

5.—ANALYSIS OF GAS CONTAINING ETHANE.

A sample of the gas containing (say) hydrogen, methane, ethane, and nitrogen is drawn into the measuring burette and its volume noted, after which it is passed through the combustion tube maintained at a low heat—*i.e.*, 250° to 260° C.—until it no longer loses in volume. The gas-burner is then shut off and the gas returned to the burette and measured; the contraction is due to hydrogen. The gas is then passed forwards and backwards through the combustion-tube maintained at a bright red heat. After combustion, the gas is passed back to the burette and again measured. Any increase in volume is due to ethane, which may be read off as the volume of ethane in the sample. The gas is passed into the potash pipette and the nitrogen residue measured. The volume of methane will be obtained by subtracting from the total volume of the carbon dioxide produced twice the volume of ethane found.

If a measurement of the volume of oxygen be made after re-oxidation of the oxidizing material, it will be possible to calculate the average carbon and hydrogen densities of the mixed paraffins; thus: Say, for instance, that the methane is 30 per cent. and the ethane is 10 per cent., total = 40 per cent.; the total CO_2 produced will be 30 + 20 = 50, and the oxygen required will be 60 + 35 = 95.

Then, $\frac{50}{40} = C_{1{\cdot}25}$ (the carbon density).

and, $\frac{(95 - 50)}{40} \times 4 = H_{4{\cdot}5}$ (the hydrogen density).

The average composition of the mixed paraffins is $C_{1{\cdot}25}\,H_{4{\cdot}5}$.

6.—DETERMINATION OF THE CARBON AND HYDROGEN DENSITIES OF VOLATILE HYDROCARBON LIQUIDS.

This determination is made by means of a measurement of the carbon dioxide produced after combustion, together with the measurement of the volume of oxygen required to re-oxidize the oxidizing material in the combustion-tube, after the combustion of the hydrocarbon.

In addition to giving the necessary data for the calculation of the carbon and hydrogen densities of mixed olefines, paraffins, &c., the combustion tube, devised by the writer, is useful in determining the constitution of volatile liquids of unknown composition. In view of the fact that considerable interest has lately been directed towards petrol substitutes for use as motor-spirit, such as can be obtained by scrubbing coal gas, coke-oven gas, &c., this method of combustion provides a ready and easy means of carrying out the work. The apparatus is convenient for the determination of the constitution of such volatile hydrocarbon liquids as pentane, carburine, light petroleum spirit, benzene, benzol, and any other such liquid which can be vaporized and mixed with a carrier gas, such as nitrogen, and remain as a vapour at ordinary atmospheric temperatures.

The method usually employed to determine the constitution of these hydrocarbon liquids is to oxidize a known weight of the substance by passing its vapour over copper oxide heated to a red heat, and absorbing and weighing the carbon dioxide and water vapour produced in suitable vessels. [Liebig, Dumas, Bunsen.] The method adopted by the writer is to vaporize a very small quantity of the liquid, employing an inert gas to act as a carrier of the hydrocarbon vapour, the volume of each being measured, and afterwards passing the whole over the oxidizing material in the combustion tube heated to a bright red heat, finally observing the volume of carbon dioxide produced. The oxidizing material being subsequently re-oxidized, we have the complete data for determining the carbon and hydrogen densities of the hydrocarbon liquid.

In order to distinguish a hydrocarbon belonging to one group from that belonging to another group, it is not sufficient to determine its carbon density without any reference to its hydrogen density, because it often happens that two distinct hydrocarbons may have the same carbon density but not the same hydrogen density, or may have similar hydrogen densities but dissimilar carbon densities. For instance, ethylene, a member of the olefine series (C_nH_{2n}), has the formula C_2H_4; but ethane, a member of the paraffin series (C_nH_{2n+2}), has the formula C_2H_6. Again,

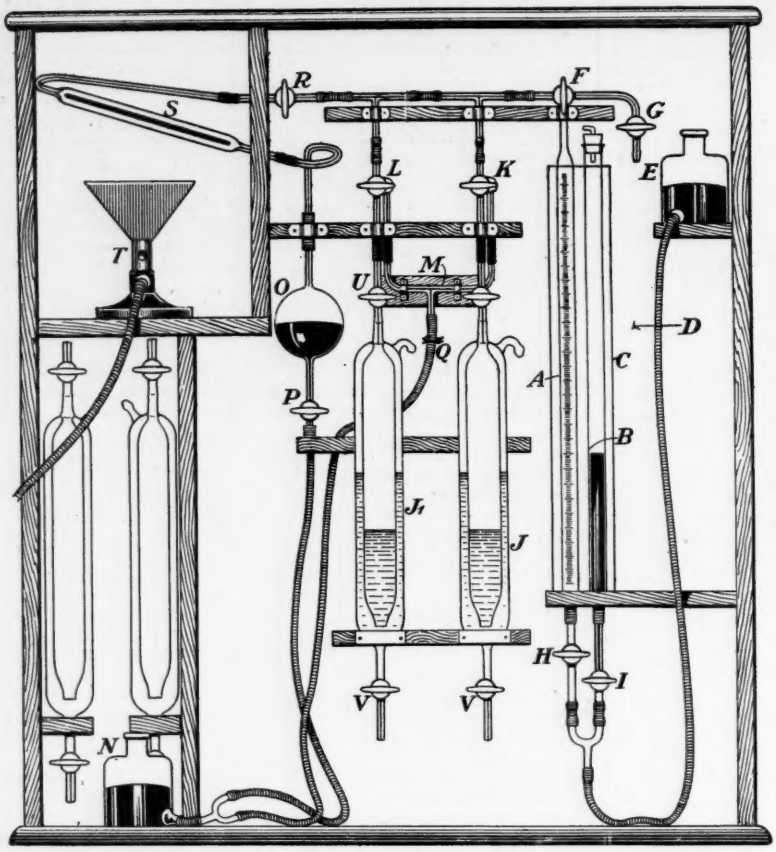


Fig. 1.—Taplay's Combustion Gas Analyzer.

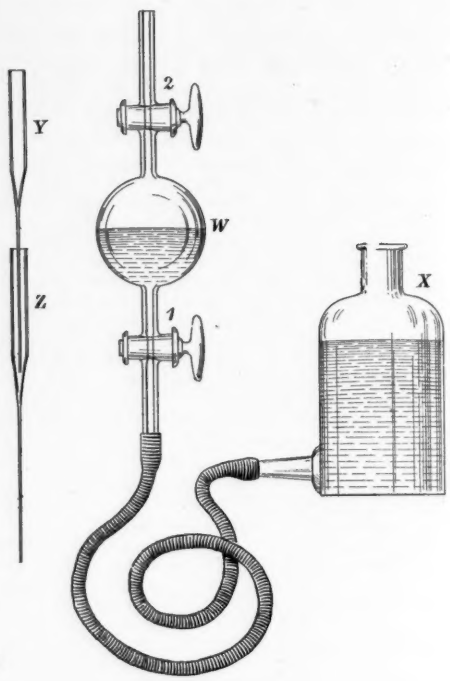


Fig. 2.

benzene, a member of the benzene series (C_nH_{2n-6}) has the formula C_6H_6; whereas hexahydrobenzene, one of the "naphthenes" (C_nH_{2n}), has the formula C_6H_{12}, and, again, hexane, a member of the paraffin series and a constituent of carburine, has the formula C_6H_{14}. A combustion of the hydrocarbon serves to identify it, and to place it in the group to which it belongs.

Manipulation of the Apparatus.*

The measuring burette, displacer, combustion tube, and connecting capillaries being already filled with mercury, begin by taking nitrogen into the measuring burette A. The nitrogen may be obtained by drawing air into a phosphorus pipette and allowing the phosphorus to absorb the oxygen. When ready, the phosphorus pipette is connected to the tap G. Note the volume of nitrogen admitted. The phosphorus pipette is disconnected, and the nitrogen in the capillaries (tap G) is discharged by means of mercury from the reservoir N. Then close the tap G. A bulb W (fig. 2), of about 50 c.c. capacity, having two short capillary necks, carrying taps 1 and 2, is fixed in a vertical position and then filled with mercury from a reservoir X, which is connected to one of the necks—say, below the tap 1. The mercury is allowed to enter the bore of the tap 2 until it is about half filled. A drawn-out glass tube *Z* is introduced into the capillary tube above the tap 2, and a drop of the hydrocarbon liquid is drawn up into the capillary of the drawn-out tube Y. The small end of the tube Y is introduced into the large end of the tube *Z*, and the liquid discharged from the former into the latter. After withdrawing the tube Y, the liquid may be easily discharged into the bore of the tap 2, which is afterwards closed, and the capillary above it filled with mercury by means of a similar drawn-out tube. The bulb W is then connected to the tap G, and the nitrogen passed forwards and backwards between the burette and the bulb until no further increase in volume takes place, and the interior walls of the bulb and the mercury appear to be dry.

We now have a mixture of nitrogen and hydrocarbon vapour. It will be well to bear in mind that too much hydrocarbon liquid should not be used, or the nitrogen may not be able to "carry" it properly. In the case of benzene, benzol, and hydrocarbon liquids of a similar nature, the mixture should not contain more than about 3 per cent. by volume of the hydrocarbon. On the other hand, carburine and motor-spirits of that type may contain as much as 8 per cent. of the hydrocarbon. A little practice will enable the experimenter to determine the proper quantity of hydrocarbon liquid to be introduced into the bulb.

After the addition of the hydrocarbon vapour, the volume of the mixture is noted at atmospheric pressure; and the increase in volume represents the volume of hydrocarbon vapour. The whole is then passed backwards and forwards through the combustion-tube, heated to a bright red heat, until no further increase in volume takes place. After combustion, the residual gas is passed back to the measuring-burette, and its volume noted. It is then passed into the potassium hydroxide pipette, to absorb the carbon dioxide produced by the combustion, and again passed into the measuring-burette and the volume of the residual gas noted. This residual gas should be equal to the volume of nitrogen originally taken, provided that the whole of the oxygen is removed from the air admitted into the phosphorous pipette. The nitrogen residue is then discharged from the measuring-burette, and the burette and capillary tubes are washed with the dilute sulphuric acid solution; the tap R being closed meanwhile. It is understood that before this combustion takes place the oxidizing material in the combustion-tube is fully oxidized.

After the combustion of the hydrocarbon, it must be re-oxidized, and the volume of oxygen is to be noted. We have now the data for the purpose of determining the composition of the hydrocarbon. Some examples are now to be given of the carbon and hydrogen densities of hydrocarbon liquids determined by this method.

Benzene.

	C.C.
Volume of nitrogen	40·0
Volume of nitrogen + vapour	41·2
Volume of benzene vapour	1·2
Volume after combustion	47·2
Deduct volume of nitrogen	40·0
Volume of carbon dioxide	7·2
Volume after combustion	47·2
Volume after passing over KOH	40·0
Volume of carbon dioxide	7·2

Then, $\frac{7{\cdot}20}{1{\cdot}20} = C_{6{\cdot}0}$ (the carbon density).

	C.C.
Volume of oxygen taken into burette	18·6
Volume of oxygen remaining	9·6
Volume of oxygen absorbed	9·0
Deduct volume of oxygen equivalent to volume of CO_2	7·2
Volume of oxygen used to form OH_2	1·8

Then, $\left(\frac{1{\cdot}8}{1{\cdot}2}\right) \times 4 = H_{6{\cdot}0}$ (the hydrogen density).

The hydrocarbon is C_6H_6 (benzene).

* For convenience of reference the illustration, fig. 1, that appeared on p. 870 of last week's issue is reproduced.—Ed. J.G.L.

PENTANE.

	C.C.
Volume of nitrogen	25·6
Volume of nitrogen + vapour	28·0
Volume of pentane vapour	2·4
Volume after combustion	37·7
Deduct volume of nitrogen	25·6
Volume of carbon dioxide	12·1
Volume after combustion	37·7
Volume after passing over KOH	25·6
Volume of carbon dioxide	12·1

Then, $\frac{12\cdot1}{2\cdot4} = C_{5}\cdot_{04}$ (the carbon density).

	C.C.
Volume of oxygen taken into burette	31·1
Volume of oxygen remaining	11·7
Volume of oxygen absorbed	19·4
Deduct volume of oxygen equivalent to volume of CO_2	12·1
Volume of oxygen used to form OH_2	7·3

Then, $\left(\frac{7\cdot3}{2\cdot4}\right) \times 4 = H_{12\cdot16}$ (hydrogen density).

The hydrocarbon is $C_{5\cdot04}H_{12\cdot16}$ (pentane). Strictly, it should be C_5H_{12}.

A sample each of carburine, coal tar, 90's benzol, and a motor spirit of unknown constitution was subjected to combustion; the specific gravity of each was determined; and a fractional distillation was also made. The following results were obtained:—

—	Carburine.	90's Benzol.	Motor Spirit.
Began to distil at	28° C.	62° C.	29° C.
Percentage volume distilling over below 100° C.	86	90	85
Distillation completed at	154° C.	112° C.	152° C.
Specific gravity (water = 1)	0·678	0·881	0·700
Constitution of the hydrocarbon	$C_{6\cdot03}H_{14\cdot12}$	$C_{6\cdot08}H_{6\cdot24}$	$C_{6\cdot21}H_{14\cdot32}$

Light hydrocarbon liquids, obtained by scrubbing coal gas, carburetted water gas, and mixtures of coal gas and carburetted water gas, were subjected to fractional distillations; the specific gravities were taken; and determinations of the carbon and hydrogen densities of the fractions were made by the writer's method. Results obtained are shown in the following tables:—

(*a*). *Coal Gas.*

Fraction No.	Boiling between, Deg. C.	Specific Gravity (Water = 1).	Carbon and Hydrogen Densities.
1	37–80	0·871	$C_{5\cdot10}$ $H_{11\cdot96}$
2	80–100	0·883	$C_{5\cdot91}$ $H_{7\cdot32}$
3	100–130	0·880	$C_{6\cdot46}$ $H_{11\cdot08}$

(*b*). *Carburetted Water Gas.*

1	28–80	0·817	$C_{5\cdot06}$ $H_{11\cdot12}$
2	80–100	0·858	$C_{6\cdot20}$ $H_{14\cdot20}$
3	100–130	0·903	$C_{6\cdot70}$ $H_{15\cdot44}$

(*c*). *Mixed Coal Gas (Coal "X") and Carburetted Water Gas.*

1	31–80	0·866	$C_{5\cdot03}$ $H_{10\cdot40}$
2	80–100	0·869	$C_{5\cdot72}$ $H_{7\cdot48}$
3	100–130	0·869	$C_{6\cdot13}$ $H_{6\cdot52}$

(*d*). *Mixed Coal Gas (Coal "Y") and Carburetted Water Gas.*

1	42–80	0·869	$C_{5\cdot16}$ $H_{7\cdot04}$
2	80–100	0 871	$C_{5\cdot81}$ $H_{7\cdot10}$
3	100–130	0·871	$C_{6\cdot14}$ $H_{10\cdot86}$

(*e*). *Mixed Coal Gas (Coal "Z") and Carburetted Water Gas.*

1	50–80	0·859	$C_{6\cdot20}$ $H_{8\cdot40}$
2	80–100	0·871	$C_{6\cdot00}$ $H_{8\cdot52}$
3	100–130	0·871	$C_{6\cdot85}$ $H_{10\cdot60}$

It will be noticed that some of these hydrocarbons, obtained by scrubbing illuminating gas, are, so far as their constitution is concerned, somewhat similar to pentane (C_5H_{12}), others are like hexane (C_6H_{14}), others, again, are like benzene (C_6H_6), and others like amylene (C_5H_{10}). That none of them is strictly in accordance with the hydrocarbons given as examples is largely due to the fact that during the distillation one fraction overlaps another. If the fractions were re-distilled once or twice, they would be purer, because the same overlapping would not take place.

Combustions of these volatile liquid hydrocarbons, and the determination of their constitution, can be made much more rapidly by this method than by the usual method, which consists in weighing the sample and sealing it in a small bulb made for the purpose; the whole being packed in the combustion tube together with copper oxide, &c. This operation, together with the actual combustion and weighing of the water and carbon dioxide produced, takes a very long time. The writer, of course, does not claim to be able to make a combustion of any hydrocarbon liquid, nor are the results obtained by the method described by him to be considered more accurate than those obtained in the ordinary way. It is, however, considered an advantage to have an alternative method of determining the constitution of such volatile liquid hydrocarbons as are met with in gas-works.

The table below gives a list of some of the hydrocarbon gases and vapours, together with the volume of oxygen required for the combustion of, and the volumes of products from the combustion of, one volume of the gas, or one volume of the vapour produced from the liquid hydrocarbon.

	Formula.	Oxygen Required.	Volume of Products.	
			CO_2.	OH_2.
Paraffin series (C_nH_{2n+2})—				
Methane	CH_4	2·0	1	2
Ethane	C_2H_6	3·5	2	3
Propane	C_3H_8	5·0	3	4
Butane	C_4H_{10}	6·5	4	5
Pentane	C_5H_{12}	8·0	5	6
Hexane	C_6H_{14}	9·5	6	7
Heptane	C_7H_{16}	11·0	7	8
Olefine series (C_nH_{2n})—				
Ethylene	C_2H_4	3·0	2	2
Propylene	C_3H_6	4·5	3	3
Butylene	C_4H_8	6·0	4	4
Amylene	C_5H_{10}	7·5	5	5
Acetylene series (C_nH_{2n-2})—				
Acetylene	C_2H_2	2·5	2	1
Allylene	C_3H_4	4·0	3	2
Benzene series (C_nH_{2n-6})—				
Benzene	C_6H_6	7·5	6	3
Toluene	C_7H_8	9·0	7	4
Xylene	C_8H_{10}	10·5	8	5

In conclusion, the writer would like to summarize some points with regard to the apparatus described in this article:

1.—It is portable, and is a complete gas-analysis apparatus; no Bunte's burette, Hempel's, Orsat's, or other absorption apparatus being necessary.

2.—The silica combustion tube, containing the oxidizing material in the form of a rod supported in the centre of the tube, is the chief feature of the apparatus. Combustions of the combustible gas are made without the admixture of air or oxygen.

3.—After the combustion, the products are swept out of the combustion tube by means of the confining fluid—*i.e.*, mercury—no inert gas (carbon dioxide or nitrogen) being required for this purpose.

4.—If the operator desires to determine the volume of carbon monoxide by absorption instead of by combustion, the oxidizing material in the combustion tube need not be fully oxidized. Nor is this necessary if, when making a combustion of the "original" gas for the determination of the constitution of the mixed olefines, the hydrogen density be taken as equivalent to twice the carbon density. Thus, no measured volume of air or oxygen need enter into the calculation. All that will be required is that, after two or three combustions have been made, some air shall be passed over the oxidizing material while at a red heat.

5.—Although the manipulation may possibly appear complicated to some readers, in reality it is very simple. One or two analyses will demonstrate to the operator that this is so.

6.—The combustion tube, containing the oxidizing material, is not confined to the particular apparatus described by the writer of this article. It can be attached to a variety of gas-analysis apparatus, either of the constant pressure or the constant volume type.

The apparatus described is made by Messrs. Alex. Wright and Co., Ltd., of Westminster, S.W., and supplied under the name of "The Combustion Gas-Analyzer (New Form)."

Electrolysis of Iron and Lead in the Soil.—A systematic study, continued during six months, at the laboratory of the Higher School of Telegraphy and at the Paris Central Telegraphic Station, led, according to the "Comptes Rendus," to the following conclusions: (1) Electrolysis of iron mains in the ground near electric tramway rails may occur when the mains are positive to the rails; and electrolysis of cables under lead may be produced as soon as the difference of potential between the lead and the rails exceeds 0·2 volts. (2) At the same difference in potential lead is attacked much less rapidly than iron.

WORKS TOPICS—XII.

By Modus Operandi.

Distinctive Colouring of Pipes.

The varieties of pipes in use in gas-works are of so complex a nature, and the pipes so large in number, that any system which will tend to simplify the distinction between one pipe and another is deserving of consideration. All those familiar with the details of a works will have on scores of occasions found difficulty in recognizing some particular pipe. The impossibility of carrying in one's head a knowledge of all the pipes in use results in endless questioning of the foreman, or other responsible man, whose duty it may be to attend to the opening or shutting of the valves and cocks of such pipes. It has always appeared to the writer of these notes that some of these men have an exceptional faculty for committing to memory the location of every pipe on a large works. Those who are most gifted with this intuitive knowledge are usually of the type that rarely makes notes. Probably, as a consequence, this faculty of observation is more highly trained than in the case of a man who is in the habit of committing everything to paper.

Be this as it may, the engineer, his assistants, and those of the men who only occasionally have reason to trace out a particular pipe, must needs remain ignorant of—at least—a large number of connections. There may, however, be at some time a vital necessity for them to know the exact position of a particular pipe. In cases of explosion, fire, or escape of gas, it is out of all reason to wait for the one individual who may have the most complete knowledge of the pipes in any part of the works. There is, therefore, an absolute necessity for those in charge to know the position of all such connections. Assuming, and I think rightly, that they cannot possibly carry in their heads a sufficient knowledge of these details, it follows that some method must be adopted of recording the run of all pipes on the works.

Some engineers have established a plan of hanging in each building a complete diagram of the valves and connections in that section of the works. This is a thoroughly good idea, and one which should be adopted in all works. Carried out completely, it would answer the purpose in most cases of emergency, and is, further, of almost daily utility to one or other of the staff or workmen. But good as this idea may be, would it not be advisable to institute in gas-works a plan definitely agreed upon by the German Engineers' Association? The Association have standardized a distinctive colouring of pipes, according to their contents, both of those in actual use and of those shown in drawings. The arrangement of colours selected is as follows: Gas, yellow; steam, white; alkali, violet; water, green; vacuum, grey; oil, brown; air, blue; acids, rose; tar, black; and a number of combinations of two colours, such as "green with red stripes," and "yellow with blue stripes" (denoting high-pressure water and producer gas respectively), to distinguish the various gases and fluids in use.

In adopting a system of this kind, it would be a great advantage to come to a general agreement as to the choice of colours, for standardization is always commendable. It is a disadvantage that the necessity of distinguishing such a large number of pipes must result in a conglomeration of colours that can hardly add beauty even to a gas-works. Apart from this such a scheme would be full of advantages for practical use. It would have a great tendency to save accidents and prevent confusion in emergencies; to help workmen and prevent mistakes; to save inquiry and assist supervision.

The difficulty of choosing suitable colours is emphasized by the large number of different fluids and gases in use in gas-works. At the same time there is equally emphasized, for the above-mentioned reasons, the necessity of distinguishing one from another. Of those in general use, there are the following:—

Gas.

Coal gas . . . . } crude and clean
Carburetted water gas . . . . . } crude and clean
Mixed . . . . . low-pressure
,, ... high-pressure

Steam.

Pressure . . . . { often two or three supplies at different pressures.
Exhaust

Air.

Low-pressure . . for purifiers
Compressed . . . for power

Water.

Fresh . often two supplies
Dirty . . for condensing and coke-quenching
Hydraulic pressure
,, exhaust
Rain-water pipes
Drains
Coal gas tar . . . } crude and dehydrated in some cases
Oil gas tar . . . } crude and dehydrated in some cases
Ammoniacal liquor
Oil-gas liquor
Electric conduit-pipe

There are, too, in connection with sulphate plants many additional pipes not specified above.

Such a question as this cannot be settled in a hurry. It needs careful consideration and the formation of a definite scheme. It is discussed at some length with a view to inducing gas engineers to give the idea some thought; and, if possible, to elicit information should there be a scheme of this sort in actual use in any gas-works. If so, I trust that the idea will be brought into the light of day, by letter addressed to the "Journal."

The Disadvantages of Hurdle Grids.

For those who revivify *in situ* there is a good deal to be said for retaining in use the ordinary flat grid in preference to those of the hurdle type. Experience proves that with grids of the latter type the gas passes through very readily and with a minimum of back-pressure; but while this may be an advantage in one direction, it may yet in others be a disadvantage. In this question of back-pressure there is a limit to the ease with which gas should pass through a purifier. If there is virtually no resistance, the box will not do much work until the pores of the oxide begin to fill up. This being so, quick changes in the series of rotation will be necessary.

Again in the revivifying of such a purifier the clean gas and oxygen will take too easy a passage through the material, thus coming into direct contact with a proportion only of the oxide. The process of revivification will, therefore be much slower than in the case of a corresponding purifier filled with horizontal grids. In this way we have disadvantages in two directions—quick fouling and slow revivifying. It is a fact that a purifier throwing (say) ½ inch of pressure will take longer—sometimes much longer—to revivify *in situ* than one throwing 2 inches of pressure. If therefore, the purifiers are of small capacity for the work to be done this disadvantage may cause much trouble.

A further disadvantage lies in the fact that extra supervision is required in the filling of the purifier; for it is necessary to exercise a good deal of care to ensure that the oxide is distributed equally throughout the box. The horizontal bars of the hurdle grids are liable to cause the material to hang-up instead of running freely under each bar. For this reason it is advisable to use a long rod to stir up the material as it runs among the grids. But this work may not be done thoroughly; and thus an easy bye-pass is made for the gas to slip through. With flat grids the weight of the material is sufficient in itself to prevent such an occurrence.

Wear and Tear.

Again there is undoubtedly more wear and tear with hurdle grids. This may not be serious, but, nevertheless, it should not be overlooked in considering the matter. Some makes of hurdle grids are of weak construction, and therefore very defective in this respect; and unless they receive gentle handling, the life of such grids is likely to be a very short one. In the case of oxide caking it is necessary to use a pickaxe in emptying the box, and it is obvious that a good many blows are received by the grids. Such treatment is inevitable at times, in spite of the fact that a hurdle grid is not constructed to stand it. Again, in discharging a purifier fitted with these grids the fact that the grid is covered by oxide of a fairly hard consistency increases the difficulty of freeing it from the oxide. This being so, there is a tendency for the men to tear the grid away before it is released from the oxide. It is, therefore, important to limit one's choice to the strongest type of hurdle grid on the market.

Expense of Discharging.

The discharging of a purifier is certainly more expensive should it be fitted with hurdle grids, especially if the oxide is at all hard. In these cases the job is by no means straightforward, for a man must control his pickaxe with a good deal of precision if he is to avoid damaging the grids. The writer of these notes has never yet succeeded in inducing the men to discharge a hurdle grid purifier by piecework, though in the case of those fitted with horizontal grids the job is accepted with avidity. At the same time, with the former type of grid in use, it is probable that a good deal more damage would be done to the grids were the work carried out by piecework than is the case when done by daywork labour.

The convenient method of bye-passing tiers of horizontal grids as they throw back-pressure is with hurdle grids impossible; and this is a disadvantage in those comparatively rare cases when serious back-pressure is experienced.

It should be stated that the disadvantages of hurdle grids are, of course, in many cases more than counteracted by the advantages, which, under certain conditions, are very substantial. At the same time, one so rarely hears anything to the detriment of the new type of grid that it appears to me to be desirable to call attention to points which might on occasions be overlooked.

Gasolene from Natural Gas.

The subject of the condensation of gasolene from natural gas was recently dealt with in the "Journal of Industrial and Engineering Chemistry" [pp. 895-898] by Messrs. G. A. Burrell and F. M. Seibert. The following abstract of the article appeared in the "Journal of the Society of Chemical Industry:" According to the experience of the United States Bureau of Mines, natural gas consists mainly of paraffin hydrocarbons, with small quantities of nitrogen, carbon dioxide, and water vapour, and sometimes hydrogen sulphide and possibly other sulphur compounds. The total paraffin content can be determined by the usual methods; but the separate determination of the several paraffin hydrocarbons is difficult. The authors have used a method of fractional distillation at low temperatures. The gas was liquefied by means of liquid air (—190° C.), and methane removed by a Töpler pump. Two fractionations at this temperature were usually sufficient to obtain pure methane. A mixture of ethane and propane was obtained in a similar manner at —130° C.; while the residue, when allowed to volatilize, yielded almost entirely propane. In the production of gasolene by condensation, three factors come into play—viz., condensation of vapours, liquefaction of gases, and solution of gases in the condensed hydrocarbons. For determining the suitability of natural gas for gasolene manufacture, specific gravity determinations and solubility tests are inconclusive in many cases, and the safest course is to test with an experimental compressor and condenser.

A SHORT REVIEW OF TEN YEARS' PROGRESS.

By ENGINEER.

IN thinking of centenaries, one is apt to forget the great progress made in the gas industry during the past decade. In the following short review, the writer aims at presenting the salient features of our advance (as shown by analysis of accounts) in a short and concise manner. Many lines of thought and investigation will suggest themselves to readers, the following up of which would yield interesting and surprising results.

Gas is one of the few necessaries of life that have decreased in price on the average during the past ten years. The prices charged in London in 1902 and 1912 respectively are shown in the following table. The writer is indebted to Field's Analysis for many figures appearing in the first portion of this article.

Company.	1902.	1912.	Decrease. Per 1000 Cubic Feet.
	s. d.	s. d.	s. d.
Gaslight and Coke*	3 0	2 6	0 6
South Metropolitan	2 3	2 2	0 1
Commercial	2 8	2 4	0 4
Brentford	2 11	2 5	0 6
Wandsworth	2 4	1 9	0 7
Crystal Palace	2 7	2 3 and 2 4	0 3 or 0 4
Croydon	2 10 and 2 8	2 5	0 3 or 0 5
Mitcham	3 8	2 8	1 0
Average London and Suburbs	3 0	2 5	0 7

* South of the Thames, 2s. 5d. and 2s. 2d. respectively.

These reductions, amounting in the case of Mitcham to 27½ per cent., and Wandsworth to 25 per cent., are all the more remarkable when one considers the fact that coal, the basis of manufacture, has increased in price to an alarming extent when purchased in the ordinary way. To the householder, coal has increased 4s. a ton during the last three or four years, or (say) 15 per cent. How, then, has this remarkable reduction in price of gas been effected in face of the increase in price of the basic element, *plus* increases to a smaller extent in the cost of all other purchases, such as meters, mains, cookers, and last, but not least, labour charges? The chief answer to this is the improved results obtained, due to the good work of the technical staff and to the contractors who have introduced up-to-date plant.

The following table gives the yield per ton of coal (or its equivalent) for gas, coke, tar, and ammonia. The prices obtained per unit of coke and tar indicate the next important point in the reduction of price. It will be noted that the increase in the price of coke is quite as much as would be expected from the increase in the price of coal, and tar has increased in value about 50 per cent.

—	Cost of Coal Per Ton.	Yield of Gas Per Ton.	Yield of Coke for Sale Per Ton.	Selling Price Per Ton.	Yield of Tar Per Ton.	Selling Price Per Gallon.	Liquor Made Per Ton.
	s. d.	Cub. Ft.	Cwt.	s. d.	Galls.	d.	Galls.
London, 1902	*13 0	*10,330	9·49	12 1	9·9	1·37	27·2
Suburbs ,,	*14 8	*10,530	9·31	12 8	10·3	1·36	24·5
Average ,,	*13 4	*10,360	9·46	12 2½	10·0	1·37	26·7
London, 1912	*14 4	12,373	9·77	14 5	9·7	2·03	30·6
Suburbs ,,	*15 4	12,308	10·16	15 9	10·5	2·16	27·1
Average ,,	*14 7	12,350	9·85	14 9	9·9	2·06	29·9
Increase	*1 3	1,990	0·41	2 6½	−0·1	0·69	3·2
Percentage, inc.	*9·3	19·2	4·3	20·8	−1·0	50·4	12·0

* Approximate.

The leakage having increased on the average figures from 5·10 per cent. to 5·63 per cent., the gas accounted for per ton is increased from 9835 cubic feet to 11,658 cubic feet, or 18·6 per cent.

The following table gives net coals for the London and Suburban companies in pence per 1000 cubic feet.

—	Coal and Other Constituents.	Received for Residuals.	Net Costs.
	d.	d.	d.
London, 1902	15·72	9·40	6·32
,, 1912	13·52	10·30	3·22
Suburbs, 1902	18·20	8·45	9·75
,, 1912	14·76	9·48	5·28
Average, 1902	16·20	9·22	6·98
,, 1912	13·79	10·12	3·67
Difference	− 2·41	+ 0·90	− 3·31

The lower net cost of London over Suburban companies is probably due to the facilities for getting water-borne coal and the larger scale of working.

The next factor in the reduction is the lowering of wages per 1000 cubic feet, due to introduction of labour-saving machinery. Although the cost per unit of production has decreased, the total wages, salaries, and bonuses have increased from £1,168,051 in 1902 to £1,264,636 in 1912, or 8·5 per cent., in London and Suburban companies, due chiefly to increased expenses in distribution, and contributions to profit-sharing, superannuations, &c. All wages in the following table are in pence per 1000 cubic feet.

—	Carbonizing Wages.	Purification Wages.	Distribution Salaries and Wages.	Total.
London, 1902	3·12	1·08	0·69	..
Suburbs, 1902	3·07	0·83	0·69	..
Average	3·11	1·03	0·69	4·83
London, 1912	1·89	0·49	0·96	..
Suburbs, 1912	1·63	0·27	1·08	..
Average	1·83	0·44	0·99	3·26
Decrease	1·28	0·59	+ 0·30	1·57
Percentage	41·2	57·3	+43·5	32·5

The increased wages in distribution are due to heavier expenses on stoves and coin-meter fittings. At first sight, it would appear that the natural growth of business (which will be shown later) would have decreased salaries, standing charges, &c., per 1000 cubic feet. The increasing costs under these heads have swallowed up all that would have been saved; and the same applies to rates and taxes. The total of all items referred to has actually increased by 1·10th of a penny per 1000 cubic feet. Charges under the headings of insurances, superannuations, profit sharing, &c., have increased by nearly ½d. per 1000 cubic feet. The amounts spent upon total repairs and renewals have naturally increased owing to the development of cooker and coin-meter business, and on the works, owing to wear and tear of machinery. The increase in weight and speed of vehicular traffic has resulted in an increased wear and tear of mains and services.

Repairs and Renewals.	Works.	District.	Total.
London and Suburban Companies, 1902	4·06	2·75	6·81
,, ,, ,, ,, 1912	4·43	5·82	10·25
Increase	0·39	3·10	3·44 =50·5 p.c.

Next, turning attention to the profits, the gross profits have decreased from 10·6d. to 9·6d. per 1000 cubic feet in the case of London companies, and from 10·3d. to 8·9d. in Suburban companies. The percentage dividend has increased in spite of this, as the growth of business has been in a greater ratio than the increase of capital expenditure. Owing to this tremendous growth, the industry rests on a sounder basis year by year, and as an investment is becoming increasingly attractive. Gas stocks do not suffer as much as other industrial securities in time of depression. In 1902 the three London companies were 4·4 times larger than the Suburban; but in 1912 the ratio is decreased to 3·7, in spite of the absorption of West Ham and Chigwell by the Gaslight and Coke Company.

The following table gives one an idea of how rapid the growth referred to has been:

—	Capital Employed.	Number of Consumers.	Gas Sold in Millions of Cubic Feet.
London and Suburban Companies—			
1902	£24,392,213	853,429	43,172
1912	£27,174,532	1,592,622	55,273
Increase	£2,782,319	£739,193	12,101
Percentage of increase	11·4	86·5	28·0

In the Provinces, the increase in gas sold is more pronounced, although the number of consumers does not show such a large percentage of increase.

The above figures point to the fact that the use of gas is increasingly enjoyed by the poorer class of consumer, which fact is borne out by the notable increase in the number of consumers through prepayment meters. The increases in the above table are 73,074, or 15 per cent., due to ordinary consumers, and 666,119, or 183 per cent., due to prepayment consumers.

The annual increase in consumption per slot-meter consumer is naturally greatest where the price is least. The figure for Wandsworth is now over 20,600 cubic feet per annum for all slots; having increased from 17,600 in 1902. The receipts for items other than gas and residuals are as follows:

London and Suburbs, 1902	1·50 pence per 1000 cubic feet
,, ,, ,, 1912	4·20 ,, ,, ,, ,,
Increase	2·70 pence per 1000 cubic feet

The increase is due, of course, to higher proportionate revenue from stove-rent and rent of coin-meter installations. Thus we

get the following concise balance-sheet of differences over the period of review:

London and Suburban Gas Companies, Average Figures, Pence per 1000 Cubic Feet Sold.

—	1902.	1912.	Increase.	Decrease
Net coals	7	3¾	..	3¼
Wages, carbonizing, distribution, and purification	4¾	3¼	..	1½
Repairs and renewals	6¾	10¼	3½	..
All other expenses, standing charges, &c.	..	..	½	..
Profit	10½d.	9½	..	1
Total	..	..	4	5¾
	1902.	1912.	Decrease	Increase.
Receipts other than gas and residuals	1½	4¼	..	2¾
Total amount going to reduction of price	..	..	4	8½
	..	..	..	4
Net	..	..	..	4½

This total amount of reduction practically agrees with the reduction for 1000 cubic feet over all the gas sold, which is not, of course, the figure of 7d. appearing in the first table; the latter is only an average (irrespective of size) of some of the companies. The London Gas Companies alone paid £97,500 in profit-sharing last year.

The above tables and data, though referring in particular to the London and Suburban companies, are typical of conditions all over the country. By the Board of Trade Returns for 1911 (the latest issued), we get the following comparison with ten years ago; the figures applying to statutory companies in the United Kingdom.

—	No. of Undertakings.	Capital Paid-up and Loans Borrowed.	Gas Sold in Millions of Cubic Feet.	No. of Consumers.
1901	705	£108,023,000	144,058	3,921,000
1911	822	£136,098,000	189,046	6,650,000
Increase	117	£28,075,000	44,988	2,723,000
Increase per cent.	16·6	26·0	31·2	69·6

To this number must be added at least 850 non-statutory companies, all small.

The total amount of gas supplied during the year would be about 192,000 millions of cubic feet. It will be seen that the additional business has been obtained with a capital expenditure of £622 per million—not eliminating amounts added by conversion for the United Kingdom; while the same figure for London and Suburban is £403 per million—leaving the figure of £700 per million for the remaining Provincial business.

The figures of capital raised are at December, 1912—

Greater London	£837	per million cubic feet sold
Provincial, Scotch, and Irish	677	,, ,, ,,
Total of United Kingdom	720	,, ,, ,,

Regarding capital actually employed, after deducting all nominal additions, the increase in Greater London was obtained with an expenditure of £230 per million sold.

A further interesting note is that the increase of sale in Greater London is more than one-fourth of that throughout the country; this increase having kept the proportionate sale between Greater London and the United Kingdom substantially the same—namely, 1 to 3·6.

INFLUENCE OF FLAME ON HEATING EFFICIENCY OF A COAL-FIRE.

AN EXPERIMENT WITH A PRACTICAL LESSON.

By G. E. Foxwell, Assistant Chemist, Koppers' Coke Oven and Bye-Product Company, Sheffield.

The burning of a piece of coal in the household grate may be roughly divided into two stages: First, the distillation of the coal and the burning of the volatile matter; secondly, the burning of the non-volatile residue, which consists mainly of carbon.

The generally accepted theory is that a coal-fire has the greatest heating efficiency during the second period, when the non-volatile carbon is being burnt. Thus Professor Lewes, in his book on "The Carbonization of Coal," p. 233, states: "The clear fire radiating out the heat given by the combustion of the incandescent carbon is doing more heating work than at any other period." This view would, on the face of it, appear to be incorrect. One pound of carbon burning to carbon dioxide gives out 14,544 B.Th.U. of heat, whereas similar weights of tar and coal gas (of which the volatile matter is mainly composed) give out about 16,000 and 19,200 B.Th.U. respectively. Hence the volatile matter would be expected to give out more heat per unit of time than would the carbon residue, in addition to which a certain amount of the carbon residue burns at the same time as the volatile matter. Theoretically, then, the fire would be expected to have the greatest heating value when the volatile products are burning. The chief consideration militating against the acceptance of this view is that, since the volatile products burn higher up in the fire, they might be expected to lose a very large proportion of their heat up the chimney.

With a view to testing this, some experiments were performed by the writer. Two thermometers were suspended about 2 feet away from the front of a fire burning in an ordinary house grate. One of these thermometers was passed through a cork fitted into the neck of a flask, in such a manner that the bulb of the thermometer was at the centre of the bulb of the flask, and no part of it was in contact with the sides of the flask. In this way, complete freedom from draughts and convection currents was obtained; and the radiant heat given out by the fire was alone registered. The other thermometer was entirely unprotected, and so registered the heat which would be received by a person in a similar position. The fire was allowed to reach a state mid-way through the second stage, when the fuel was incandescent, and all the volatile matter had been expelled. The temperature registered by each thermometer was then taken, and about 1½ to 2 lbs. of coal fed on the fire. The reading of the thermometers was taken every five minutes for two hours; and the results are given in diagrammatic form in the accompanying chart. The continuous line shows the radiant heat, and the dotted line the temperature registered by the unprotected thermometer.

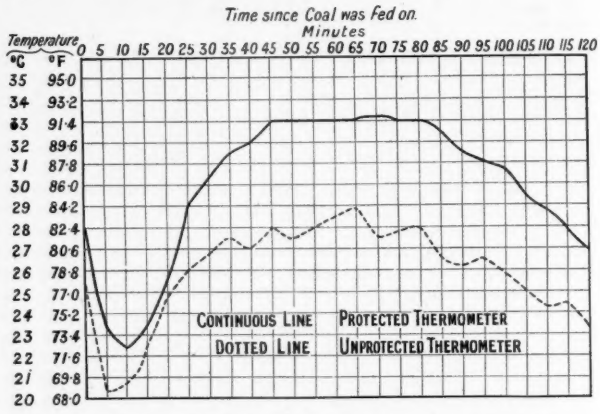


Diagram illustrating Fluctuations in Heat given out by Coal-Fire.

It will be noticed that a considerable drop in temperature occurred as soon as the coal was fed on—caused by the expenditure of heat necessary to heat-up and decompose the coal. The volatile matter got properly alight by the end of twenty minutes, and the heat received from the fire appeared to be about the same as at the beginning of the experiment. After an interval of thirty minutes, the bottom of the fire had become quite incandescent. The volatile matter continued burning steadily, though not with any great volume of flame, until the end of an hour and twenty-five minutes, when the flame finally died out completely, save for a few traces of carbon monoxide. At once the temperature as registered by the thermometer began to fall, and continued falling steadily (with two slight exceptions) until the end of the experiment. After an hour and fifty minutes, a small piece of coal, which had hitherto escaped decomposition to a large extent, burst into flame. At the same point we notice that the unprotected thermometer rose a little, though the enclosed one continued falling. This seems to show that though a certain amount of the radiant heat was utilized to decompose this coal, the sensible heat of the room was increased. This view is borne out by another fact not shown in the diagram. After two hours had elapsed, the fire was stirred up so as to cause it all to burst into flame. The unprotected thermometer was observed to rise slightly, while the enclosed thermometer continued to fall with a somewhat accelerated speed at first, and then remained practically constant for a while.

The general inference to be drawn from this experiment seems to be that the thermal efficiency of the fire is greatest when the volatile matter is being burnt, and not during the burning of the carbon residue alone. And, apart from its purely scientific aspect, the experiment also teaches us a practical lesson. The diagram plainly shows the fluctuations to which a room heated by a coal-fire is subject. To keep the temperature more nearly constant, it is obvious that more coal must be fed on before the flame has died away. Such a proceeding is, of course, most uneconomical, and unless the coal is fed on very frequently, and in small pieces, a little at a time, uniformity of temperature cannot be maintained. It is clear, then, that to keep a room heated by a coal-fire at a constant temperature requires a great deal of trouble, and is most uneconomical. It is one of the paradoxes of to-day that, in spite of the great discoveries of science in every branch, such a wasteful, dirty, and troublesome method of heating our rooms is allowed to continue. But signs are not wanting that a more rational state of things is at hand.

The foregoing experiment shows clearly that a fire gives out its greatest amount of heat at the time when the volatile matter is burning and the bottom of the fire is in a red-hot condition. But

this condition only lasts for a comparatively short time in the coal-fire. In the gas-fire, on the other hand, this state of affairs is permanent. There is no expenditure of heat necessary to decompose freshly fed-on fuel. Hence a gas-fire gives out a maximum amount of heat the whole time, and it is possible, and indeed easy, to keep the room at a constant temperature. The other advantages of gas are obvious. There is no trouble required for putting on more fuel. All the dirt and inconvenience consequent upon the use of coal are done away with, and last, but not least, the pollution of the atmosphere and the blackening of our buildings and monuments are entirely avoided.

THE NATIONAL COMMERCIAL GAS ASSOCIATION MEETING.

[Communicated by an American Correspondent.]

Both our National Gas Associations met this year in historic cities. Richmond, the home of the Southern Confederacy, welcomed the Gas Institute in October, and Philadelphia, the birthplace of the United States, was host to the National Commercial Gas Association from Dec. 1 to 6. Philadelphia with us typifies conservatism; but no note of progress or vitality was lacking in its hearty welcome to the convention, or in the deliberations of the latter.

The vanguard of the largest assemblage of gas men in our annals arrived early in the afternoon of Monday, Dec. 1. Two hundred came in special trains—a feature now of all our gas meetings. The total registration was over 1600, and of this number 1135 were members.

The convention opened at 10 a.m. on the Tuesday with an address of welcome by the Hon. George D. Porter, the Director of Public Safety of Philadelphia, speaking on behalf of the Mayor, the Hon. Rudolph Blankenburg, unavoidably absent because of illness. The Director referred to Philadelphia as a city of home-owners and as welcoming gas men with keen interest, because of its pride in the United Gas Improvement Company—a local product and standing for the highest ideals in the gas industry. In reply, Mr. Edgar N. Wrightington, of Boston, dwelt on the convenience and universality of gas, the responsibility of gas companies for ensuring proper economies in manufacture, and adequate service to the public, and the equal responsibility of the latter that control of the gas companies should never involve unwise interference with details, or prevent that margin of profit indispensable as an incentive to proper development.

Then followed the Directors' report, a summary of the year's doings, including references to the work of certain Committees (which will be noted later on, in connection with the reports of the Committees themselves). The report spoke of the usefulness of the monthly "Bulletin," of the employment agency maintained by the Secretary, and of the suggestion that moving picture films advertising the use of gas be prepared and put at the members' disposal. The membership is 2653—a slight loss since last year. The cash balance is $10,000—a large gain.

The Committee on Public Policy recommended national advertising as a supplement to present local advertising. The Committee on Company Membership reported that the total company membership was now 268, but should be very much larger. The Committee on Membership and Local Sections showed the educational advantage of section meetings. The Manufacturers' Committee made an appeal to the manufacturers to enrol as company members. The Committee on Accounting submitted certain suggestions as to new business accounts for further criticism, and recommended that the Association act in concert with the Gas Institute on accounting matters.

At this point the President, Mr. C. Willing Hare, of Philadelphia, surrendered the gavel to Mr. C. M. Cohn, of Baltimore, and delivered the annual address. It was concerned almost entirely with a study of the Association's work and needs. He appealed for more contributors to the "Bulletin," and greater use of its "Question Box." He spoke of the benefit that would follow the employment of a permanent statistician to furnish to all inquiring members commercial data such as results from advertising, special selling campaigns, &c. He showed the needs for more funds. He said the Association as a separate body was indispensable to the gas industry, and that by amalgamation with the Institute the benefits ensuing from the present friendly rivalry between the two societies would be lost; and as in one association the work would have to be done at simultaneous sectional meetings, many gas men would lose their present opportunity of attending both engineering and new business meetings. The address was received with great applause.

The Nominating Committee reported the following ticket which was unanimously elected.

President.—P. S. Young, Newark, N.J.
First Vice-President.—A. P. Ewing, Detroit, Mich.
Second Vice-President.—W. H. Pettes, Newark, N.J.
Third Vice-President.—J. C. Rushin, Atlanta, Ga.
Secretary.—Louis Stotz, New York City, N.Y.
Treasurer.—H. B. M'Lean, New York City, N.Y.
Directors (to serve two years).—A. F. Staniford, Brooklyn, R. C. Ware, Boston, T. R. Elcock, Philadelphia, A. F. Krippner, St. Louis, C. V. Roberts, Philadelphia.

The Committee on Time and Place recommended Minneapolis for the meeting in December, 1914; and their report was adopted with no dissent. The Committee on Affiliation reported adversely to any amalgamation with the Institute, and urged that any overlapping fields of work be cared for by Joint Committees. The morning session ended at this point.

The afternoon session opened with the report of the Committee on Relations with Customers. This report was presented only in abstract, as, in common with most of the Committee reports that followed, it had been printed and distributed in advance of the meeting. In this way, much valuable time was saved for the discussions, which even then had in most cases had to be cut short. The report "emphasizes most strongly that the services of the public should be as prompt, efficient, courteous, and business-like as it would have to be if there were a rival gas company in each town." "It shows the importance of having each employee know the details of all branches." "It advocates the more general education of the public by . . . advertisements covering interesting details of the business, and setting forth the company's policy towards its customers." In the discussion (which lasted for two hours), the seventeen speakers emphasized the above points and, in addition, called attention to the absolute necessity of adequate pecuniary reward to deserving employees on the part of any gas company desirous of being well represented in its dealings with the public. There are many company heads on both sides of the water whose views as to employees' salaries would have been profitably broadened had they been among the listeners.

The Committee on the Gas Equipment of the Home in a few words presented a sample illustration and the table of contents of the booklet they are preparing as a "first aid" for the architect, builder, and gas-fitter. It will give much needed publicity and information about the many appliances available to the gas user to increase comfort and economy of household operation. The booklets will be issued in two sizes, and will furnish at moderate cost to each company an effective advertising agent. This concluded the afternoon session.

There was no session on Wednesday morning; the time being left open for an inspection of the appliance exhibit. In the afternoon, the Committee on Domestic Fuel Appliances, after presenting their report in three minutes, had the pleasure of hearing a two-hour discussion from twenty-six participants as to the best methods of increasing the sale of gas for domestic fuel purposes. The all-gas kitchen is the goal; and co-operation for this purpose with the plumbers and the hardware merchants was advocated by many.

Progress was reported by the Committee on Salesmen's Handbook, and it is hoped that the book will be ready next year. It will supply in convenient form data of value to every seller of gas appliances. Before adjournment, the meeting listened with great interest to the Board of Educational Control. Three thousand persons are now enrolled for the course in the Utilization of Gas Appliances, of whom over 600 are employees of one company. This is the third year of educational work by the Association, and much good is expected from the present course. In every place where there are many enrolments, a class leader has been appointed to hold monthly meetings to discuss the lessons.

On Thursday morning, outdoor lighting was discussed for one-and-a-half hours subsequent to a committee report on the subject. Various plans for the sale, installation, and maintenance of outdoor arcs were considered, and there seemed to be about as many advocates for a rental as for a sales plan, although it was the general opinion that maintenance by the company was essential to the good appearance of the lights. Many of the remarks applied equally well to indoor lighting, which was next taken up, also as a committee report. It urged more education of consumers in the care of lighting appliances, the value of maintenance schemes, and showed the economy of gas as compared with electricity. In the discussion, Mr. Arthur Hewitt gave some interesting data from Toronto, and Mr. C. O. Bond, of Philadelphia, spoke as President of the Illuminating Engineering Society.

The afternoon session was devoted to advertising, and was presided over by Mr. T. R. Elcock, of Philadelphia, the Chairman of the Committee on Publicity. Mr. W. F. O'Donnell, of Philadelphia, spoke on "Maker-Dealer Co-Operation in Advertising"—a description of the manner in which manufacturers of appliances could co-operate with companies to supply travelling demonstration outfits, window displays, and other advertising. "Checking Advertising Returns," by Mr. J. M. Brock, of Rockford, Illinois, was to the effect that, although it is generally impossible to trace direct results from advertising, their existence is unquestioned. Mr. F. P. Kelsey, of Chicago, talked of "Special Selling Campaigns," and how the foundation for their success was laid by proper advertising which aroused curiosity in the mind of the consumer and prepared a welcome for the salesman. "In the "Value of Effective Display," Mr. R. O. Jasperson, of Milwaukee, dwelt on the importance of proper arrangement of all advertising matter.

Then came one of the most interesting incidents of the entire meeting. This was the contribution of Mr. F. W. Goodenough on "The Work of the British Commercial Gas Association," which was read by Mr. Elcock in the absence of the author. The story of the origin, aims and methods, and splendid performance of your youthful commercial body was closely listened to, and at its conclusion the members, by rising vote, directed that a message of thanks and appreciation be cabled to the author.

Mr. Goodenough's recital served to buttress-up the recommen-

dation of the Committee on National Advertising whose report followed. Subscriptions do not as yet justify the inception of this campaign, but it is hoped that in a short time the requisite amount will be obtained. Some of the Companies believe that local advertising alone will suffice; but most of the non-subscribers have failed to give any consideration to the subject, and in the meantime the electric interests have begun a national advertising campaign. The advocates of national advertising assert that not only is more prestige derived from advertisements in the magazines of national circulation than is true of newspaper advertising, but also the former advertising costs much less than the latter.

The session concluded with a talk by Mr. Herbert N. Casson, an advertising expert, in which, in vivid language, he pictured the creation of public appreciation and desire for an article by proper advertising.

On Friday morning, the Committee on the Development of Industrial Fuel presented a highly-praised report. It stated that "industrial gas service means to know the fuel for every heat proposition, and to render industrial gas service means to know and acknowledge that there are different fuels, that each has its uses and limitations." Therefore, in addition to gas, it considered from a commercial standpoint, fuel oil, producer gas, gasoline gas, and electricity. In a discussion of two hours, the speakers dwelt on the necessity for exact knowledge by industrial gas engineers, the value of such trained men to their companies, and the incentive of good pay requisite to develop and hold the proper human material.

Mr. W. H. Gartley, of Philadelphia, addressed the meeting as President of the American Gas Institute. He believed that the two Associations could do better work apart than together. He urged his hearers to help in making a success the International Gas Congress to be held in San Francisco in 1915.

The report of the Committee on Standardization of Gas Appliance Specifications, advocating the adoption of the gas-fixture specifications approved by the Gas Institute, was ordered to be printed. Then, after the usual final resolutions of thanks, the convention came to an end. Its six sessions were marked by a promptness in assembling never before equalled by a Gas Association, by an attendance varying from three to five hundred, and by a general participation in discussion that conclusively proves the wisdom of limiting the presentation time of all papers and reports. The meetings were held in the Academy of Music, a spacious theatre, with a seating capacity of 1000 on the lower floor alone.

Having only sketched the activities of the meeting sessions, there remains to be given some account of the appliance exhibit (always an important feature of the Association's conventions), and of the social gaieties that lightened the serious work. For the success of the exhibition, a central location was necessary, which resulted in the choice of the Horticultural Hall, adjoining the Academy of Music and but a short distance from the hotels. This accommodated 76 exhibitors occupying 100 exhibit spaces; and while the 8000 square feet of space available on the two floors did not provide all the room needed, the resultant congestion was preferable to a larger hall in a more remote location. The exhibits were visited by the members throughout all hours of the five meeting days, but especially on Monday afternoon, Wednesday morning, and Friday afternoon—left open for this purpose. The exhibits comprised a complete line of lighting and fuel appliances, domestic and industrial, besides a few showings of meters and tools. As usual, the lighting of the meeting and the exhibit halls and of the adjacent street was made an opportunity to show the possibilities of gas. The outside of the Academy of Music was illuminated by 27 gas arcs of 500-candle power, the interior by upright, inverted, and semi-indirect incandescents. Horticultural Hall on its exterior glowed with 23 outside arcs. The interior lighting was from many varieties of units; the semi-indirect bowl fixtures being especially attractive. The street lighting was furnished by 36 high-pressure lamps of 1000-candle power, each containing two inverted mantles, enclosed in one 18-inch alabaster globe. The posts were 14 feet high, located on the curb and equally spaced on both sides of a roadway 69 feet wide for a distance of 845 feet. The result was abundant illumination without any glare.

From its social side, the meeting was as successful as from the business view point. Anyone who came with the idea that the East is not as hospitable as the West went away with a new thought. The visiting women (over 100 in number) were entertained at tea on Monday afternoon; at lunch on Tuesday, with a concert following; by an automobile trip, followed by tea, on Thursday afternoon; and by a theatre party Friday night. With the men they attended President Hare's reception and supper on Tuesday night, and a theatre party and supper, followed by dancing, on Wednesday night. The men attended some boxing contests on Friday night, and, to the number of 150, went to Atlantic City on Saturday in a special train to finish the week by a golf tournament.

The reader of the above account will not fail to appreciate the significance of such a meeting as has been described. It is a far cry back to the comparatively small meetings at which the details of gas manufacture and distribution were discussed and no thought given to the sale of the product. In the years to come, if both with you and with us the economy and manifold uses of gas are not adequately presented to the millions whom we stand ready to serve, the fault will not lie with the workers in the Commercial Gas Associations, British and American.

GAS LIGHTING OF INTERIORS.

At the Meeting of the American Commercial Gas Association in Philadelphia (Pa.) early this month, the Committee on Indoor Lighting presented a long report, from which we make the following extracts. It was fully illustrated by photographs showing various examples of lighting interiors.

The subject of interior gas illumination is of vital importance to every gas company. In the past two years many progressive gas companies have shown that it is possible to make great gains in residential lighting business by the application of aggressive selling methods, embodying the campaign idea in the selling of the smaller units. The installation of a large number of burners, however, is of no more importance than maintaining these burners to give satisfactory service, so that the customer may obtain the greatest benefit from their use.

It is usually conceded that little has been done to aid the residential consumer in securing the best service from gas illumination; but inasmuch as the holding of existing business and the future expansion of gas lighting will largely depend on the maintenance of burners in good operating condition, the means of securing this result should be of vital interest.

The instruction of the consumer or the performance of burner maintenance for him entails considerable expense. The latter method may be either gratuitous, each installation being visited at fixed intervals, the labour being supplied free and the consumer charged only for the material used for replacing, repairing, &c.; or a charge may be made of a definite sum per month or per year, in consideration of which the company agrees to maintain the installation in perfect condition, furnishing all labour and material by visits at regular intervals, and, in addition, taking care of complaints that may arise between the calls of the maintenance men. The choice between the two methods will naturally depend to a certain extent on local conditions.

Of the two methods, the first mentioned—the instruction of the consumer—may be made quite effective. It is the consensus of opinion, however, that the best results would be secured by a combination of the two methods—that is, regular inspection by men who are capable of correcting the more difficult mechanical troubles, and instruction of the consumer in the care of lamps by the demonstrators employed. Whichever method is adopted, the work of the maintenance man must be done both carefully and thoroughly.

In putting either of the methods into effect, it is of great importance to start right. Every installation should be placed in first-class operating condition before the inauguration of the service. Undoubtedly a greater proportion of whatever prejudice exists against gas lighting may be traced to the use of obsolete appliances and improperly maintained burners; and the elimination of these disturbing factors will be the most effective advertisement that can be secured by any gas company.

A very small section of the public are familiar with the radical improvements that have been made in gas lighting appliances during the last few years. In spite of the large number of modern self-lighting burners which have been sold, and which are giving satisfaction, it is still probably true that the great majority of gas users imagine that the only way of lighting a gas-lamp is by the use of a match. Furthermore, a large proportion of gas consumers are not familiar with the advantages of the incandescent burner, their opinion of which is largely based upon the performance of the very earliest burners and mantles; and they still believe that incandescent burners are a source of trouble without compensating economies.

It is of the utmost importance that the relief which is offered by modern improvements in gas lighting appliances should be set before the public convincingly and continuously. Economy is one of the greatest advantages in the use of gas, and effective means should be taken to bring the merits of gas lighting in this respect before the public, particularly as claims concerning the alleged economy of other illuminants have received wide publicity. Undoubtedly, economy is an important consideration to the majority of the public; and this condition must of necessity be accentuated by the constantly increasing cost of living. While radical movements in electric lighting appliances have been made, there has been no lack of similar development in gas appliances; and the most recent in the latter are even of a more radical nature than anything that has been accomplished in the development of electric lamps. It is reasonable to expect that the present economic superiority of gas lighting will be at least maintained in the future; and there is much promise that this advantage will be considerably increased. By taking effective means to bring these facts before the public, and raise the standard of operation of existing gas appliances by adequate maintenance, gas companies may obtain an increase in the lighting business far beyond the present expectations.

The realization of our present opportunities, however, will require more than simply a greater activity along conventional lines. A large portion of our activity must be directed towards replacing the inefficient open-flame tip, no matter how attractive it may be from the standpoint of consumption, by appliances which shall give the consumer greater value for his money and more satisfactory illumination. The existence of thousands of open-flame burners might not be serious if there were no competing illuminant available, as was the case in 1875. To-day,

however, the open-flame burner cannot be regarded as anything but the finest kind of advertisement for competing illuminants, and an invitation to the electrical salesman. Furthermore, the tendency to base legal requirements relating to gas quality on calorific value rather than candle power makes it advisable to replace as quickly as possible the open flame, which depends for luminosity upon the lighting power of the gas, by the incandescent type of burner.

In the sale of gas lighting appliances there are generally two methods—one the conventional way, by which territory is more or less thoroughly canvassed by the regular sales force of the gas company; and the other the campaign method, which many gas companies have prosecuted to excellent advantage. Both have quite a distinct place in the operations of commercial departments. Neither can supplant the other. Undoubtedly the campaign method is the most effective means of giving publicity to modern methods of gas illumination. No company should content itself, however, with even the most successful campaign. It should be borne in mind that the business that may be obtained in this manner is a comparatively small proportion of the total obtainable. In every case the territory should also be canvassed by salesmen competent to advise concerning the selection of fixtures, portables, &c.; the systems of lighting to be used under different circumstances, such as indirect and semi-indirect, which depend largely upon the colour of walls and ceilings, and the many special applications of gas lighting in stores, show windows, &c.

In soliciting lighting installations of any character, the work of the salesman may be made more effective if he is equipped with attractively bound folders containing photographs of installations, which he may show as examples of satisfactory gas lighting, particularly if they are photographs of local installations to which he can refer the prospective consumer. [A number of installations of this character were reproduced in the report.]

The salesman should be conversant with the requirements of good illumination, and able to plan installations with assurance that good results will be obtained. He should be especially cautioned against advocating the use of one particular type of lamp for each and every installation. Nearly every merchant prefers, to a certain extent at least, individuality in his lighting installation; and the saleman should attempt to add distinctive features, wherever this may be done without prohibitive expense. There is nothing more prejudicial to the future development of gas lighting business than the prevailing monotony and sameness in gas lighting installations. Where economy is the principal consideration, particularly economy of maintenance, large units may be used to good advantage. The better classes of lighting may be handled most efficiently by fixtures of special design.

Care should be taken that the sale of lamps with clear globes or with globes of very high brilliancy is not encouraged in places where the lighting units will fall within the normal range of vision. Where the newer systems of illumination, such as the indirect and semi-indirect, are used, the customer should be impressed with the necessity of providing light walls and ceilings, for without these the installation cannot be expected to give satisfactory results.

In planning lighting installations for special purposes, such as show windows, bowling alleys, billiard rooms, &c., the salesman should be taught to recommend the type of lamp which the exercise of a little judgment and common sense will indicate as most satisfactory for the purpose. The main thing for the salesman to consider, in designing any special lighting, or, for that matter, lighting of any character, is that it is very important to throw the light on the goods or surfaces which require illumination, and to shield the eye of the observer as much as possible from brilliantly lighted surfaces. In window lighting particularly it is always desirable to conceal entirely the source of light from the passer-by. A visible light source in a show window not only detracts attention, but reduces by contrast the apparent illumination upon the goods displayed; so that a window in which the light sources are visible always appears much more dimly lighted than a similar window in which the goods receive equal illumination, but in which the light sources are entirely concealed.

In cases where low first cost of installation and low maintenance expense is the principal consideration, and freedom from shadows and the artistic appearance of the installation in general is of secondary importance, much larger units may be used than in situations where the reverse is the case. While, in general, the use of large units is not favourable to the elimination of objectionable shadows, yet in many cases where the walls and ceilings are very light in colour and the lamps may be hung at a considerable height, large direct lighting units give very satisfactory results.

Indirect lighting, or semi-indirect lighting in which the indirect portion predominates, is generally more satisfactory than any system of direct lighting wherever clerical work is done. Recent tests by an eminent psychologist show that the efficiency of the eye is reduced very rapidly under any system of illumination in which light sources of the brilliancy encountered with the ordinary commercial globes or reflectors are employed; and the use of commercial types of lighting units is not to be recommended for office illumination.

It is rather difficult to convey in a simple and usable form the information required in planning installations. If, however, the salesman will take the trouble to observe the various installations coming under his notice which give satisfactory results, he will, with the assistance of the following table, be able to recommend the number and sizes of lamps required to illuminate ordinary store or residence interiors with assurance that satisfactory results will be obtained. In the table are shown the current consumed by various types and sizes of electric lamps, and opposite these the size gas-lamp which may be used to replace the electric lamp.

Electric Incandescent Lamps.		May be satisfactorily replaced by Incandescent Gas Lamps as shown below, provided similar Shades or Reflectors are Used.	
C.P.	Watts.	Type and Size.	Cub. Ft per Hour.
8	25	..	..
16	50	..	..
32	100	Upright Junior	2·0
		Inverted ,,	
16	40	..	..
20	50	..	..
32	80	Upright Junior	2·0
		Inverted ,,	
7·1	10	..	..
11·5	15	..	..
16	20	..	..
21·4	25	..	..
31·2	40	Upright Junior	2·0
		Inverted ,,	
51·7	60	..	..
88·5	100	Inverted Standard	4·0
			4·5
134	150	Upright Standard	5·5
250	250	Inverted Large Single Mantle Lamp	10·0
		,, 3-Mantle Arc	14·0
400	400	..	..
500	500	..	..

In residences there is very seldom any problem of obtaining sufficient illumination by the use of incandescent gas-lamps, inasmuch as the fixtures usually provided, if equipped even with the smallest sizes of gas-lamps, will furnish more than adequate illumination for the interior. By far the most common fault with residence lighting as done by gas is the furnishing of three or four times the light required. This excessive illumination is not only useless, but is actually less satisfactory as regards the effect upon the eyes. The principal consideration in residence lighting, when providing lamps of proper size, is the appearance of the installation from an artistic standpoint. The individual taste of the consumer will govern the type of illumination, whether direct, indirect, or semi-indirect, and to a large extent the style of fixture, whether inverted or upright. There is practically no choice between the two latter systems for residence lighting, and the selection should rest upon artistic grounds and personal preference.

Factory lighting offers a better field for cultivation by the gas company than is generally realized. The minor refinements of control, &c., which are among the principal advantages obtained by our electrical competitors, are of very little moment in factory illumination. Economy, which is one of the strongest points of gas lighting, is of paramount importance; and in many lines of business it will receive greater attention in the future. Furthermore, the possibilities for industrial fuel business are becoming more and more apparent to gas companies. The same salesman who calls upon the factory manager with reference to fuel appliances may also direct his attention to the desirability of gas lighting; and the latter business can therefore be solicited at a minimum of cost.

The relative economy of gas and electricity in factory illumination will, of course, depend upon the relative prices, which vary in each situation. But where conditions are favourable to the gas company, factory lighting business should be obtained with comparative ease; and factory lighting installations are generous consumers of gas. The salesman should be encouraged to avail himself of the information published by manufacturers of lighting appliances and by his company regarding the location, control, &c., of lighting appliances, particularly as regards special applications, such as window lighting, bowling alley lighting, &c.

[Appended to the report are reproductions of a number of typical information sheets of the character referred to, showing the arrangement of lamps and piping, methods of installing distance lighting systems, and photographs of actual installations which might be used by the salesman either to guide himself in planning lighting systems, or shown to the consumer to impress him with the excellent lighting effects obtainable by the use of incandescent gas-lamps.]

Oxidation of Coals at Moderate Temperatures.—This subject has been investigated by Herren K. A. Hofmann, K. Schumpelt, and K. Ritter; and the results are given in the "Berichte der Deutschen Chemischen Gesellschaft" [No. 12 of 1913]. The authors have already reported that amorphous coal is oxidized by chlorate solutions, made active by means of osmium tetroxide, at the temperature of the water-bath—the products being carbon dioxide, mellogen, and mellitic acid. In further experiments, they have now found that carbon is much more readily oxidized at moderate temperatures than has been supposed. Thus a dilute aqueous solution of calcium hypochlorite acts energetically on it; the products being carbon monoxide and dioxide. Amorphous carbon in presence of alkalis at 120° to 150° C. gives dark brown and red colloids, and then yields formate and oxalate, and finally carbonate.

COMPLAINTS, THEIR TREATMENT, AND SOME NOTES ON UNDERGROUND WORK.

By Alex. Paterson, of Glasgow.

[A Paper read before the Scottish Junior Gas Association (Western District) on Dec. 13.]

In this paper I intend to deal with complaints solely from a street mains point of view—that is, complaints regarding underground pipes only. Complaints regarding supply after the pipe leaves the ground until it reaches the meter, and complaints regarding the meter and appliances, I leave to be dealt with by those more intimately connected with that side of gas distribution. There are many different experiences which we, in such a big supply area as Glasgow, have to deal with very often, which, in a smaller area, might only seldom happen. But if in this paper I can anticipate some of these difficulties, and let some of our members have ready a way out when these difficulties crop up unexpectedly, the object of the paper will have been achieved. Street mains complaints may be divided into three parts:

(1) Partial deficiency of supply, or "Want of gas."
(2) Total deficiency of supply, or "No gas."
(3) Escapes from ground.

Partial Deficiencies.

A partial deficiency of supply may be local or general. A local complaint, or a want of gas in one service pipe, may be caused by water, or solid matter such as rust or naphthalene, collecting in the branch. The first thing an emergency man should do with a complaint of this description is to uncouple the inlet to the meter, and listen to the flow of the gas. The presence of water will generally be detected by a gurgle being heard. If the flow is steady but weak, the deficiency is caused by some solid obstruction. In the case of a tenement, this information may be obtained by drawing the plug in the T-piece which is generally found at the end of the "lying pipe" in the entry.

Water in the Pipe.

If there is water in the pipe, it will have one of two causes. Either there is a drip pipe or drip crane which has filled up, and partially sealed the pipe, or the pipe itself has, owing to some subsidence, sunk and collected enough water or liquor to affect the supply, or has been broken and let surface water do so.

In the first case the remedy is obvious—open the drip crane or pump the syphon. In the other case there is only one permanent remedy—open-up the ground and raise the service pipe where it has sunk. If it is late in the afternoon or evening when the complaint is received, a temporary relief may be obtained by blowing-back the water into the main with a service cleanser. But this is only an expedient, and the branch must be put right to avoid a recurrence of the trouble. Regarding drips on malleable

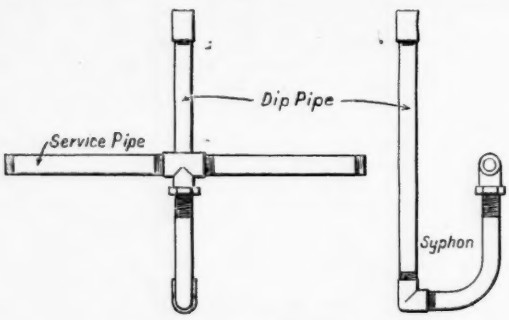


Fig. 1.—Service Syphon.

iron services, I may say that we have entirely discarded drip cranes; and on all new branches where a drip is required, we are substituting a swan-neck pumping tube. This consists of a T-piece on the branch with the off-set looking downward, a bend out of this, then a knee, and a vertical pumping tube, enclosed at the surface by a surface cover. We have found this as effective as, and much cheaper and safer than, the drip crane. Fig. 1 will show this more clearly.

Naphthalene or Rust.

In the case of an obstruction of the service by solid matter, the pipe must be uncoupled at the most convenient slip screw, and be cleared. If naphthalene be suspected, some solvent such as benzol should be poured into the branch, and a little time allowed for it to take effect. The length of time varies according to the amount of naphthalene in the service. I have seen it take effect almost instantly, and I have known it to take as long as twenty minutes. In regard to naphthalene stoppages, I should like to say that, while a solvent is very handy when lighting-up time is near at hand and time presses, I have not very much faith in it as a remedy. We, on the district, of course, cannot cure naphthalene, but we can, to a certain extent, alleviate the trouble. We have found, for instance, that in most cases the crystals require a starting point—that is, a place to which they can adhere. By measurement with the cane or wire from the saddle to the stoppage, we found, in many cases, that the block was at a coupler, and on examination we generally found that the pipe end at this point had a distinct burr inside, caused by blunt cutters. All malleable iron pipes are now rimered at the ends before they leave the store, in order to take away the ridge.

Another common place for a stoppage is at the double bend turning up to join the close pipe. The most troublesome of these were found to be bent nearly at right angles, causing the gas to impinge sharply on the bend, and thus deposit naphthalene. All double bends are now made as obtuse, or slow, as possible. The saddle was another trap; and it is here, I think, that we have made the greatest improvement. Formerly, all our screwed saddles were cast with an annular recess on the part of the outlet next the main, to allow for a little shift in the saddle without encroaching on the hole in the main. This left a landing round the hole of from $\frac{1}{4}$ inch to $\frac{3}{8}$ inch, and, as the gas struck the knee or bend outlet from the saddle, the crystals were deposited on the landing, and the hole in the main gradually blocked. We have now remedied this. The saddle is put on and jointed for good before the hole is bored. The hole is bored with a tool formed with a Ruscoe drill and a screw feed, worked with an ordinary tap key if on top, or a ratchet side key if on the side. Not only does this give a perfectly parallel outlet and a dead-fair hole, but loss of gas in boring any size hole is practically *nil*.

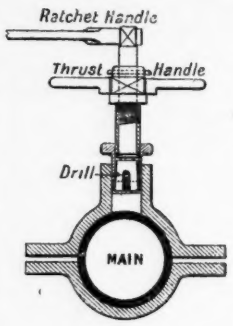


Fig. 2.—Boring Machine.

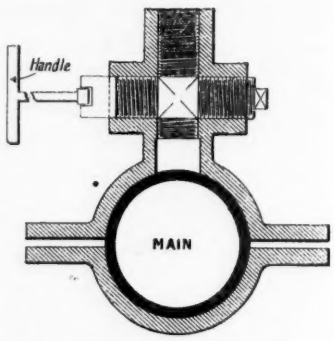


Fig. 3.—High-Pressure Connections.

Another type of saddle in which we use this tool, and of which it may interest you to have an account, is the saddle we have been using for our high-pressure work. This saddle has a three-way outlet. While the hole in the main is being drilled, the horizontal outlets are plugged. When the drill is withdrawn, a brass plug is inserted, and screwed-down to block the outlet at which the connection has to be made. Then the plug at that point may be withdrawn and the service proceeded with. When the connection is finished, the internal plug is withdrawn far enough to clear the outlet, and a permanent plug inserted at the top. If it should afterwards be necessary to examine the service pipe at the saddle, it is only a matter of drawing the top plug and screwing the internal plug sufficiently far down to block the outlet, when the pipe can be disconnected without loss of gas.

We are also experimenting just now with a naphthalene trap, or benzol bath. This is made up of a piece of 3-inch malleable iron pipe, with special caps fitted on each end. Both these caps are tapped at the top to fit the branch, and the holes can, of course, be made to fit any size of branch. On the bottom of the cap nearest the main a $\frac{1}{2}$-inch hole is tapped, in which is screwed a knee, out of which a dip tube rises, by means of which the depth of liquid in the bath may be tested. The bath is filled to the level of the bottom of the service pipe with benzol. Any naphthalene crystals carried in suspension in the gas are deposited into, and dissolved in, the benzol, and so do not collect in the service enough to block it.

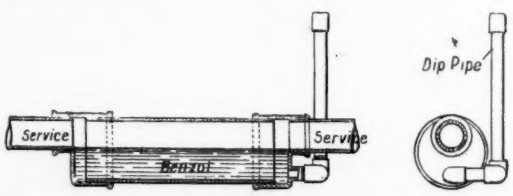


Fig. 4.—Naphthalene Bath.

If the solvent does not take effect, then the conclusion may be come to that the stoppage is caused by rust. This may be cleared by opening the branch at the slip screw in the close, and wiring the pipe. But we find in practice that it is more satisfactory to open also at the main, pull the wire through, and then blow any loose rust away with the service cleanser. A service pipe which has become choked with rust should, however, be carefully examined for thin places and pit-holes before closing up again, and, if in any way suspicious, should be renewed. It is cheaper

to renew a branch and be done with it, than to come back shortly afterwards to break-up the footpath again for an escape.

General Complaint of Want of Gas.

In the case of a general complaint of "want of gas" in a street or a district, we must look for the cause to the main or mains. It may be that the consumption on the particular street or district has outgrown the supply, and the mains have become too small to deliver enough gas. But an up-to-date gas undertaking, which tests pressures all over the system periodically, will not be taken by surprise by such a complaint, but will have provided against it either by increasing the size of the mains, or by increasing the pressure to the district.

Locating the Cause.

Such a deficiency may, however, crop up suddenly, which cannot be put down to that cause. Then we may look for some breakdown. If the mains are linked-up, it is generally possible to locate the deficiency between two points. You will find a point at one end where the supply becomes affected, and another point at the other end at which it becomes all right again. This may be done roughly by observing the street lamps, or by taking pressure at different points. All syphons should then be examined in the stretch. If they are all right, there is nothing for it but to open-up the main. It may be necessary to do this in several places before the subsidence (which is generally the cause of this type of stoppage) is found. Then, if it is a sudden dip caused by some disturbance of the ground underneath it, the main should be stripped and raised; but if it extends for some distance, as often happens in moss, it will be found cheaper to put on a syphon at that point.

When a main is not linked-up, although the case becomes more urgent, it is generally easier to locate the stoppage, as the sudden drop of pressure at one particular spot will mostly indicate the affected part. But, wherever possible, mains should be linked-up. They may be kept separate by district stop-cocks or valves, and these connections become invaluable when any stoppage has taken place. The district inspector of mains should know the exact position of all the stop-cocks or valves, and whether they are shut or open, so that he can immediately direct the emergency men where to go and what to do.

Dark Lamps.

Another complaint of want of gas which gives our department great trouble, although comparatively trivial, is that of "dark lamps." Now, I am safe in saying that 90 per cent. of dark lamps are caused by unsuitable fittings. At the foot of the lamp rod there is screwed a square knee. Many of these knees are right-angled, which is bad enough, but many more are acute-angled—whether owing to their shape or their tapping, I do not know. But this means that the piece brought out for our connection has the fall the wrong way—that is, into the knee. The branch-man who connects this lamp will always notice this; and, in order to get a fall to the main, he can only push the rod back out of the centre of the pillar, hard against the back of the pillar, and wedge it there as best he can. This very often gives the pipe just run enough. In filling-up the hole, however, this wedging is sometimes displaced, so that the rod regains its original position, and the fall is wrong again. Gradually the knee fills, and we get a complaint of dark lamp. Now this could be avoided if the knee were made a little obtuse, or if it were tapped a little bit off the square. It would also be avoided if no knee were used at all, and a bend took its place. In these days of root pillar lamps this should not be difficult.

Total Stoppage of Supply.

In regard to the second type of complaint, that of total deficiency, or "no gas," the foregoing applies equally well. It is only a matter of degree. It is much more serious, of course, and may involve the undertaking in claims for compensation. That is one reason why I am surprised we trust so much to luck with a trunk main that cannot be linked-up. Take a trunk main supplying an outlying district. It may have a dozen syphons on it—maybe more. Every one of these syphons is a danger. I have known a syphon on a 12-inch main make less than 3 inches in a month, and yet the syphon filled in ten hours, owing to a subsidence. Had the syphon been on an unlinked trunk main, the consequences would have been serious, especially had it happened at night. I think that every syphon on such a main should have either some sort of a high-water alarm, or, what is much simpler and cheaper, a self-acting syphon of the old type inserted at a danger level—that is, level with the bottom of the pipe. You may say that this is going back with a vengeance; but I will explain. The old style swan neck was screwed into the bottom of the main, was never pitched, but was covered completely up, and allowed to run dry or rust into holes at its leisure. In the case of such an auxiliary to a pot syphon, it would be properly pitched and protected, and would also have a dip rod, so that the syphon man could inspect the seal every time he inspected the syphon. In the case, then, of a sudden flooding of the syphon, the water would be unable to rise any higher than the bottom of the pipe.

Another point we have to be very careful about, in regard to a complaint of no gas at night, is not to clear the stoppage late in the evening, unless it is possible to warn every consumer who might be affected. A great many people, especially those with

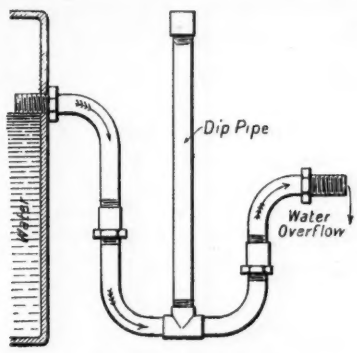


Fig. 5.—Self-Acting Syphon.

young children, do not extinguish the light at night, but go to sleep leaving it turned down. If a failure of the supply occurs, the light of course goes out, and if the main is cleared without warning, the possibilities of a disaster can easily be seen. This is especially so with an unlinked trunk main, where a small town might possibly be affected.

The Humorous Side of Stoppages.

There is often, however, a light side to the stoppage complaint. Many curious causes have contributed to them. I had a workman the other day who dosed a ¾-inch service pipe very patiently with benzol for some time. When his patience gave out, he opened up the pipe and put his cane through it. The net result was a cork, ¾-inch diameter at the large end. Another man was sent out to an urgent case of no gas, to find that it had not been turned on at the meter. But of all these cases, I think Glasgow holds the record. While a 7-inch Glasgow Gaslight Company's main was being renewed some years ago, the astonishing discovery was made of the well-preserved body of a hen in the main. It had apparently run up the main while it was being laid, and stayed there. On turning up the main-laying book of the Company, we found that this pipe had been laid about sixty years previously. It is a remarkable testimony to the preservative power of gas that, on this mummified fowl, not a feather was missing. It was in perfect preservation.

Underground Escapes.

Escapes of gas from the ground in a city must be treated seriously, and none but properly trained men should be sent to attend to them. The risks to life and property are so great that to send an unintelligent, untrained man to search for one is to invite trouble. If the escape is reported from a house or a shop, the first thing generally done on arriving is to call on the complainer, and find out where the smell is strongest. It may be a very slight escape, or it may be a very bad one. A good way to begin is to put the meter on the test, by seeing that all the cranes in the house are turned off and then observing the pointer on the test index. If it is moving, then the escape is from the internal fittings, and the meter should be turned off until the leak has been repaired by a gas-fitter. If not, the ground should be examined outside, first by piercing, and afterwards, if necessary, by opening up. This is the time when a careful man shows himself. His first action, on withdrawing the bar, will be to go on his knees and use his sense of smell. He can tell at once whether it is necessary or safe to use a light. Not only so, but he can tell by the feel of the ground through which his bar has gone, whether it is safe, even with a slight smell, to use a light.

In a city under granolithic or asphalt pavement, the ground very often settles down after the pavement has been formed, leaving a cavity below, which may enclose an explosive mixture; or the ground may have been made up with large stones or boulders, which form a series of pockets, and act in the same way. On a light being applied to a pierced hole in such a pavement, a series of shots will be caused, one firing the other. They may be slight, or they may be strong enough to lift yards of paving. Needless to say, no light should be used in such a case. The ground should be pierced in several places adjacent to the complainer's house, and the sense of smell used to determine through which the most gas is coming. The ground should be opened at that point to the bottom of the main, and the gas followed until the escape is found. If no trace of gas is found by piercing the footpath, it will still be necessary to open-up the service pipe where it enters the wall, and examine it there. The escape may be found in the wall, where it would have free passage into the house, and would not come back into the ground.

Dangers of Escapes in the House.

Again, the supply pipe may be laid through a cellar underneath the house or shop, and the escape may be coming from there. If so, an electric torch should always be used to examine the pipes. If such a lamp be not available, it may be possible to locate the leak by passing the hand along the pipe or by smelling it. If the escape is a bad one, and the cellar badly ventilated, it will be necessary, after marking the point of leakage, to disconnect the pipe outside before attempting any temporary repair. Then,

when the gas has cleared away, a naked light can be used with safety, and the repair properly executed.

If a bad escape is reported during the night from a tenement, it is not only necessary to see the complainer, but also necessary to call on the houses on either side and above. The escape may be as bad, or even worse, in any of these houses, and if the inmates are asleep, and not awakened, a suffocation case will certainly occur. If no answer is given to repeated knocking or ringing of the bell, the assistance of the police should immediately be obtained to force an entrance. It is surely much better to pay for a damaged lock than to run the risk of destroying human life; and no workman could be blamed for taking strong measures if he had the slightest fear that anyone was in danger. If an escape is found to come from a broken main in the afternoon or evening, it may be repaired temporarily by bandaging it with strong canvas coated with white lead and tied thoroughly with strong string, and it may be repaired permanently the next day. But, if the break should be discovered earlier, material should be sent for and the permanent repair executed at once, in order to save double opening of the ground.

Repair of Mains.

In connection with the repair of mains, I am in favour of a more general use of split collars of all sizes. So far, I have only used two of these, and both were on 24-inch mains, which were only broken partly round their circumference. But, in many cases of broken service mains, the break is so clean that it would be a simple matter to put on a split collar. The present method of repairing mains is to cut out a portion of the main at the break, and insert a new pipe and a solid collar. The split collar would not only save a pipe, and—equally as important—a joint, but would also entail a saving in surface repairs. Also, in my opinion, it would be as good a job.

While I am on the subject of broken mains, I may state that I am no believer in deep mains. The opinion is commonly held that the earth on top of the main forms a protecting haunch, and takes up the weight of passing traffic. This may be so; but my experience has been that the great majority of mains are broken by underground subsidence, caused either by underground operations or else burst water-pipes washing away the subsoil. When that is so, the earth on top of the main, instead of protecting it, is an added weight for it to carry. Some years ago I for some months took a note of the cover on all broken mains in my district. I found that the commonest cover on a broken main was about 3 feet Very few of them were what we would call shallow pipes—that is, pipes with less than 18-inch cover.

Underground Tangles.

The type of escape I have referred to is only one of the many types we have to deal with, and one of the easiest to find. In Glasgow, the main thoroughfares have been so taken up with other services, that it is becoming more difficult every day to lay a main across them. We have gas service, gas trunk, water service, water trunk, hydraulic, Post Office telephone, Post Office underground telegraph, electric arc pipes, electric feeders and cables, and tramway ducts. Of these, the Post Office pipes, arc pipes, and tramway ducts are loosely jointed, and form easy channels for escaping gas to travel through. This it generally does, until it reaches a manhole, or, in some cases, many manholes.

In the case of arc pipes, it generally finds its way into the arc-lamp pillar. I had one experience of the door of a pillar being blown open by an explosion caused by a boy who was lighting matches on the door. We had no difficulty in finding the fault in this case, a leaky joint within 3 feet of the pillar being responsible. We were not so fortunate in another case. An escape of gas was reported by the Electricity Department's lamp trimmer, not at the base of the lamp, but at the top of the pillar. The lamp stood at one corner of one of the busiest crossings in the city. We opened the ground at the base of the lamp, at the point where the cable entered, and took off the splits. It was found that the gas was travelling through the arc pipe. The splits were then clayed-up at that point to keep the gas out of the pillar and so prevent explosion. The ground was then pierced along the line of all our mains near to, or crossing, this pipe, but no trace of gas was found. We then opened-up the ground on the splits one after the other, and followed the gas, until, after a day and night's hard work, the escape was located on a 12-inch faucet split on the bottom, about 100 yards from the pillar at which the escape was noticed.

A complaint of gas in a tramway manhole is also troublesome to deal with. The gas may have travelled a long distance before it has been discovered and reported by the manhole man. It is advisable, then, to start by claying-up the ducts in the manholes affected. This serves a double purpose. It allows the manholes to clear themselves of gas, and renders them safe, and it also, after they have remained clayed-up for some time, acts to show between which two manholes the leakage is taking place. This may be found after an interval, by taking the clay out of the ducts one by one and smelling them. The particular duct or ducts into which the gas is entering will still have the strong smell of fresh gas, and the others will either be clear, or will have the musty smell of dead gas. The workman will then proceed in the usual way, by piercing the ground in the suspected area, to locate the escape. As a preventative against escapes into tramway manholes, it should be an axiom in a mains department that no crossing, unless absolutely indispensable, should be left in the ground below tramway rails.

Regarding escapes into electric manholes or into section pillars, again the case is different. The gas cannot travel through the cables, but it can always find an easy road in their track, and sometimes we find it travelling a good distance in that way. It thus finds its way into the manhole. In searching for an escape of this description, care must be taken, if a light be used, to see that the manhole cover is previously removed. If not, it is nearly a certainty that the gas will remove it forcibly. Not only should the cover of the manhole complained of be removed, but, if there is another one connected by a cable not far away, the cover of this one also should be removed. I know of a case where, although the cover of the affected manhole had been removed, on a light being applied, the cover of one on the other side of the street was blown into the air—fortunately without doing any damage.

An important point in searching for an escape of this description is to have someone from the electrical mains department on the ground to point out the position of the cables. These cables, at the point where they enter the manhole or section pillar, are generally shallow, and if their position is not known, it is the easiest thing in the world, in driving a bar through the concrete, to pierce the cable, and I may tell you a pierced cable costs money. It is always safer, when working near them, to open the ground right away, and to use the pick very carefully.

Another channel for gas, which very often misleads the workman who is searching for an escape, is a dry store conduit, commonly known as a "rumbling drain." These should rather be called "rambling" drains, as they generally appear to have a strong aversion to being laid in anything like a straight line. This peculiarity makes the tracing of them, and consequently the tracing of the escape, a very difficult and tedious matter, unless you can get hold of some roadman, who is also nearly the oldest inhabitant, and saw it laid in the year of the short corn, or something of that kind. If the drain has been superseded by a more modern drainage system, and is out of use, the complaint may be stopped by filling up the end from which the gas is emerging, and as it is being traced it should be filled up wherever found, until the escape has been located. This ensures that, if an escape should recur at that point, it cannot give the same trouble by getting into the drain. The same thing applies to all empty pipes. When a crossing or a main of any description is cut off, and is not worth the cost of lifting, the ends of the pipe should always be cemented up solid, to prevent any loose gas getting into them. An escape of this type is one at which light should be used very carefully or not at all, as in most cases, where gas has got into the drain, it is in such proportion to air as will form an explosive mixture. The explosion may travel a great distance and do much damage both to the roadway and to property.

Gas in Water-Mains.

But, if a dead pipe is a channel for gas, it is possible also for a live water-pipe to convey it. This, on the face of it, appears to be an impossibility; but I will give you an experience of my own. It happened some few years ago. At the time we were greatly troubled in the Tradeston district with railway gas. Gas from the railway gas-works sometimes got into the sewer, and, coming out from the manholes, created a smell of gas all over the district. On April 1 of one year I was on Saturday afternoon duty, and during the afternoon I received a complaint of gas burning at the water taps in two works close to one another in West Street. Remembering the date, I expected it to be a hoax, but went over with a workman to make sure. I found to my surprise that the complaint was in good faith, and that, although the gas was dying away, when the washhand basin was filled there was a decided smell of it, and it was even possible to get a slight flash when a light was applied to the water. This gave me something to think about. After investigation I found out that the water department's men had been packing a valve on the main about half a mile away from the works. To enable them to do this, as the valve was at the lowest point of the main, all the water was run off into the sewer, which at that time had a quantity of railway gas in it. When the pipe emptied, the gas took the place of the water. The main ended at the works gate, and when the water was turned on it drove the gas right to the end of the pipe. Consequently, when the water tap was opened, it gave out a mixture of Pintsch gas and water. This complaint, however, turned out a blessing in disguise, as, on the occurrence being reported to the Statute Labour Department, they took the matter up, and I am glad to say that, in that district, the railway-gas false alarm is a thing of the past.

DISCUSSION.

Mr. G. H. M'Cowat (Glasgow), commencing the discussion, said that Mr. Paterson, in regard to the cleaning of services, had not mentioned the method of explosives. He himself did not approve of them; but he had seen them recommended in several standard works. He mentioned instances where the cure would be worse than the disease. In the case of split collars, they found in Glasgow pipes laid in the early stages of gas making to which it would be extremely difficult to apply them. Mr. Paterson had given them no enlightenment on the subject of cables fusing. This was a frequent occurrence. They got cables fusing on the top of pipes and leaving a hole as if it had been bored out. He also pointed out how necessary it was to pay the greatest attention to the supervision of surface repairs.

Mr. A. Scott (Provan) remarked that the amount of damage

done to the pavement by opening up struck him as astonishing. He would like to commend the idea of having a subway with mains led through. This would clear them of the tangled scheme of operations which had been referred to.

Mr. WILLIAM BLAIR (Helensburgh) said the paper recalled many incidents to his memory; he had gone through many similar experiences. He was at one with Mr. Paterson as to the form of syphon he had for service pipes; but he could not approve of the overflow that he had from the syphon. In a wet district the main might be filled and much damage done. This had been his experience. In sandy soil, however, it was right enough. He instanced the case of laying a pipe 14 or 15 years ago. It had been lying at the side of the track, and schoolboys, in passing, had thrown in a cricket ball, wickets, and road metal. The pipes were laid with these strange contents, and only $\frac{1}{16}$ of an inch was left for the flow of gas over the ball. This had given a supply for a number of years, until six or seven consumers who had amplified their demand through cookers had to complain of the supply. He thought it was naphthalene—it was due to the cricket ball. In another case he remembered getting a tartan shawl inside a 9-inch pipe. There was an instance where examination into a complaint led to the discovery that a workman, in laying the pipes years before, had clapped in a piece of clay and left it there; leaving only $\frac{1}{4}$-inch free space. He held that elbows and square knees should never be used in connection with a gas supply. Split collars were handy at most times; and these and lead wool he found convenient for repairs.

Mr. JAMES M'GHEE (Glasgow), referring to Mr. Paterson's allusion to the use of benzol for temporary cleaning out, said they had tried a great many of the stock solvents on the market made up for the purpose, but had found them of very little avail. In most cases, however, with 80 per cent. benzol a few minutes served to dissolve the naphthalene crystals; but now he heard that in certain experiments it was taking 20 minutes. In their own case they arrived at their conclusions by taking definite quantities of naphthalene and definite quantities of the solvent. In most instances naphthalene remained after the attempts at solution. Eighty per cent. benzol was the only thing that completely dissolved the naphthalene. He was somewhat doubtful of the proposed naphthalene trap. There was the difficulty of keeping the benzol in the cylinder constant; and he was afraid if many traps were used, it would be an expensive method of dealing with the trouble. The author made no allusion to the service cleanser, and the charging of it with a quantity of benzol. They found it very useful. In cases where they thus charged the cleanser, the stoppage was removed right away. In regard to "dark lamps," their lighting department was responsible for those acute angle knees at the foot of the lamps. He noticed, however, that the department had adopted round knees; but this did not alter the effect, for if the knees were properly made they were right-angle bored. This could be altered by the bend of the pipe itself, or an obtuse knee could be got—one was on the market now. Split collars could be used very much oftener than they were. In old mains of varying diameter, of course, trouble might be caused. His experience corroborated Mr. Paterson as to the depth at which mains should be laid. The great bulk of breakages were caused by underground subsidence. He, too, recognized the drawback of "rambling drains." They had a very striking example of the trouble some time ago in a main thoroughfare. A tenant complained, and it took them ten days to locate the cause of the complaint. Some days there was no smell whatever—it depended on the direction in which the wind was blowing. The escape was 150 yards away from the particular tenement from which the complaint had come. Examination served to emphasize the necessity of closing-up the ends of old pipes that had been cut off.

Mr. DAVID FULTON (the Secretary of the Association) said the paper had put before the members those things that they would have to deal with in future, if they had not already dealt with them. The paper did not lend itself to criticism; one could only corroborate. Mr. Paterson, however, in dealing with escapes and searching for means for their detection, had alluded only to the piercer and the sense of smell. Had he used the leak indicators they saw advertised so often? As to the question of deep or shallow mains, it was knocked into them that mains should be deep. Mr. Paterson gave the lie to this. He would like to know what amount of cover mains ought to have. There was the danger of pipes being frozen if they were near the surface.

Mr. THOMAS CARMICHAEL (Dalmarnock), in speaking of the benzol bath, referred to an experiment he had seen carried out the previous day. In this, 1000 c.c. were taken, and gas was bubbled through it at the rate of 6 feet per hour. At the end of six hours there was a diminution in volume of 215 c.c.—or nearly 20 per cent. In a second experiment, the gas was passed over the benzol as in the case of services, and the diminution was 190 c.c. —thus proving that the benzol would all be evaporated after from 30 to 32 hours. How long would the benzol last in the tank? The naphthalene trouble, as had been said, must be rectified at the works. There were several ways of doing it: (1) Washing with a suitable oil; (2) modifying the condensation so as to utilize the solvent action of the tar oils; (3) by injection of oil through a spray into the gas as it left the works.

Mr. SHEPHERD (Glasgow) remarked that it was only within recent years that the city of Glasgow had experienced the naphthalene difficulty. He gave a warning that large consumers being troubled with it would take the first opportunity of getting some more suitable and reliable service than gas if naphthalene continued to be deposited in the pipes.

Mr. R. S. STUART (Glasgow) asked the author what he meant by the statement in his paper about the high-water alarm, as there seemed to be something in it.

Mr. A. WRIGHT (Lockerbie) remarked that in his district the mains were only 1 ft. 3 in. deep. In his previous place, the road-roller was kept from going over the road; but when the Company changed hands, the roller came and broke nine 1-inch services and a 4-inch main. The question of depth, he held, depended a good deal on the soil in which the services were laid.

Mr. J. BELL (Kirkintilloch) said that in his district, where they purified with oxide and used air for revivification, he had never had a single stoppage through naphthalene. He had had it in the works, but never in the district. He attributed the absence of naphthalene in the district to one cause—they used in their carbonizing process 15 to 20 per cent. of third-class cannel coal. Why could this not be done in Glasgow?

Mr. J. F. COLQUHOUN (Glasgow) said he would like to know how the great expense entailed in sending men out after complaints and their treatment could not be turned in the direction of affording money for obviating naphthalene at the gas-works, as the weakness lay in the making, not in the distribution.

The PRESIDENT (Mr. John Wilson) in closing the discussion, said that the cream of it seemed to be naphthalene. With regard to clearing the services of this trouble, his experience had been that they must put the solvent into the pipe first, and then force afterwards with the service cleanser. The naphthalene bath had been misnamed. They would not get the naphthalene to dissolve in the bath and remain there. In regard to breakages and subsidences, it seemed to him that they had to keep their eyes on other departments as well as their own to ensure that any workings they might undertake would not interfere with their pipes. In taking complaints one had to be very careful. It was annoying to a fitter to carry his material to the scene of a complaint and find that it was due to a penny sticking in the meter. With regard to the use of split collars, where should the line of demarcation be drawn in their application to sizes of pipes? Under 8 inches it was cheaper to cut out. He thought some of the speakers had been hard on the manufacturers with regard to the naphthalene trouble. If it were possible to keep naphthalene from going into mains, it should not go into them. What cured naphthalene in one district would not cure it in another. Some English gas-works had spent thousands of pounds trying to determine as a fact what would cure naphthalene, and had achieved nothing. If they could keep the gas dry, he thought, they would not have so much naphthalene.

Mr. PATERSON, in reply, said he did not sympathize with the use of explosives. There were certain pipes which, if you even looked too hard at them, would fall in. Answering the Chairman, he held that he would use a split collar in any size of pipe down to 2 inches. He had had no experience of cables fusing, though he had known of it in other districts. His paper was confined to his experiences. He agreed with the claim of necessary supervision of surface repairs. Referring to the remarks of Mr. M'Ghee, he said that in using benzol it ran along the bottom of the pipe. He did not see that the cleanser would make any difference unless a nozzle was used and one got a swirling motion in the benzol. He pointed out that in speaking of the difficulties with "dark lamps" he was not speaking so much of naphthalene as of water. If they had no naphthalene in Glasgow, they would still have considerable trouble. Until four years ago, they did not know what naphthalene was in Glasgow. He was firmly convinced that shallow pipes were safer. Questions had been asked regarding the water alarm. The idea was a float suspended from a valve led into a valve seat in the syphon cover. When the water rose to the danger level, it lifted the float and so opened the valve, and let a little gas through to light a red danger lamp. The cost of a subway for their pipes in a city like Glasgow was prohibitive, though the idea was splendid. He should say that in every town-planning scheme an underground subway for services should be included.

A vote of thanks was warmly accorded the author.

Natural Gas in the United States.—According to the United States Geological Survey, the natural-gas industry has become one of the leading industries; and were it possible to transport the gas as coal, petroleum, or other fuels now in use are transported, it would be the leading fuel of the world, and its value would probably exceed that of any other commodity. As it is, enormous quantities are wasted annually. The important features of the year 1912 were greater production, the extension of pipe-lines to new communities, the consequent increased consumption of gas for both domestic and industrial purposes, and the higher prices. The total estimated consumption in 1912 was 562,203,452,000 cubic feet, valued at about £17,000,000, an average price of 7½d. per 1000 cubic feet, compared with 512,993,021,000 cubic feet, valued at £15,000,000, an average price of 7¼d. per 1000 feet, in 1911. The number of domestic consumers supplied with gas in the United States in 1912 was 1,621,557, and the value of gas consumed for domestic purposes amounted to £10,000,000; while the number of industrial consumers was 15,936, and the value of gas consumed by them was £6,700,000. On the assumption that 28,000 cubic feet of gas equal in heating power a ton of coal, the fuel displaced in 1912 was equivalent to approximately 20 million tons of coal.

COMPULSORY RETURNS BY WATER UNDERTAKINGS.

By JOHN CHISHOLM, Engineer and Manager of the Airdrie, Coatbridge, and District Water-Works.

[A Paper read, Dec. 13, before the Institution of Water Engineers.]

The legal obligation to keep and supply statistics relative to public undertakings is not by any means a novelty, for it is already applied to all electricity undertakings. The form prescribed by the Board of Trade (which applies both to England and Scotland) requires not only financial returns, but also statistics as to the number of units generated, sold, &c. All authorized gas undertakings in the United Kingdom, whether controlled by companies or local authorities, are required to make annual returns as to the details of their working, and to make up their accounts in the form prescribed by the Gas-Works Clauses Act, 1871, which also applies both to Scotland and England. Tramways afford another example of compulsory statistics. Regulations have been made by the Board of Trade which apply to all electrical tramway undertakings in the United Kingdom, requiring them to furnish monthly returns, on prescribed forms, of general and electrical accidents. At the end of the financial year, a statement showing the revenue and expenditure of the concern must also be furnished; and certain technical records have also to be kept and sent in when required. Educational, harbour, police, and railway authorities are also required by law to keep and transmit complete statistical records to the proper Government departments; and similar returns are required in connection with agriculture, fisheries, and mines and minerals privately owned.

NEED FOR STATISTICS.

In all these cases, the advantage of, and even the necessity for, such statistics being compulsory and of universal application is not open to doubt or objection from anyone; and the reasons which justify them in the cases referred to are surely not less important in regard to the national water supply. The need for such statistics has often been officially recognized. In 1893, the Royal Commission on the Metropolitan Water Supply urged that water authorities should be under the obligation of keeping and supplying records as to water-levels in wells. The Royal Commission on Sewage Disposal, in their fifth report (1901), recommended that a central authority be established having control of all water supplies, and to deal more particularly with:

1.—The protection of water supplies from pollution.
2.—The collection of information as to the water supplies available in various parts of the country.
3.—The collection of information as to the need of water in various parts of the country.

Again, in 1910, the Joint Committee on the Water Supplies Protection Bill referred in their report to the repeated recommendations, and stated that:

> All assert the same principle, that there is urgent need for a survey, at once comprehensive and in detail, of the water supplies and water needs of the country, and for the adoption of measures for conserving the supply and disposing of it to the best advantage, and they strongly recommend (first) the establishment—within the Local Government Board or independently, as may seem best to the Government—of such a central administrative authority as is contemplated in paragraph 356 of the fifth report of the Royal Commission on Sewage Disposal, and (secondly) the division of the country into watershed areas, and the appointment for these areas of local representative boards, who, subject to the guidance and control of the central authority, should prosecute systematic and continuous inquiries into the water supply of their jurisdiction; take all necessary measures to husband such supplies, both surface and subsoil; secure their preservation from pollution; and advise on their allocation for sanitary, industrial, and other purposes.

Further, in a report of a Committee of the Royal Commission on Canals and Waterways, published in 1911, it is stated:

> It is to be regretted that statistics and information of the rainfall available (or "run-off") in various districts of England and Wales, differently situated with respect to elevation, amount of rainfall, and geological formation, are not collected by any department and published for use in investigations such as the present, forming part, as it does, of an important question referred to this Royal Commission.

PARLIAMENTARY REQUIREMENTS.

Lastly, Parliament has on two occasions required the collection of certain particulars relating to public water-supplies—namely, in 1878, when the Local Government Board made inquiries of the various "sanitary authorities" then in existence, and in the following year presented a return dealing with the particulars received under the following heads:

1.—The population according to the census of 1871.
2.—The source from which water was supplied.
3.—The arrangements made for the supply, whether by reservoirs, wells (artesian or otherwise), rivers, if filtered or not, and any other arrangements.
4.—Amount of daily supply and whether or not the supply was sufficient.
5.—Whether the supply was constant or not, and the quantity used daily.
6.—The rateable value of the district.
7.—The capital cost of the permanent works (if any).
8.—The annual payment for principal and interest on moneys borrowed for the work.
9.—The average annual cost of maintaining the works.
10.—The annual amount of the water rates and rent (if any).
11.—The Act of Parliament or other authority under which the works have been executed.
12.—What improvements (if any) were considered necessary.

Also, in November, 1910, the House of Commons ordered a return from every water undertaking in England and Wales giving the following particulars:

1.—The powers (if any) under which the undertakers are authorized to supply water.
2.—The limits within which the undertakers are authorized to supply water.
3.—The places actually supplied.
4.—The sources of supply, their nature and sufficiency.
5.—Particulars as to the works, the quantity, and the quality of the water supplied.
6.—The area and population of the district and the number of houses therein.
7.—The number of houses supplied with water from a piped service.
8.—The names of the undertakers providing a supply of water.
9.—The source, nature, and sufficiency of the supply where there is no piped service.

These statistics have been collected by the Local Government Board, but have not yet (November, 1913) been published.

With the exception of the annual statements of accounts, water authorities are not at present under any statutory obligation to keep records of their working; and it is indeed surprising to find that so very little has been done towards securing the general return of statistics relative to water undertakings. In several instances recently where the author has been invited to advise water authorities, he has found that no complete statistics of this character were available. The important point seems to the author to be the creation of a uniform system of keeping records relative to the water supply and the working costs of the various water undertakings in this country. In some cases, no doubt, water engineers do prepare annual reports on their undertakings, while others submit to their boards monthly or fortnightly statements relative to the work. Others, again, keep such records for their own personal use, and do not submit them to the water authority unless required for a particular purpose. This being the position of matters with the larger undertakings, it may be assumed that the statistical information of the smaller works is even more meagre and unsatisfactory.

Under the circumstances, it is not to be wondered at that it is rarely the case for any water-works to be provided with facilities for taking measurements, either of the supply available or of that utilized; and so long as a sufficient supply exists, no attempt is made to take any regular records. Then, when a shortage of supply becomes imminent, the engineer in charge or a consulting engineer is called upon to advise, and has to rely upon rainfall measurements, often obtained at sites outside the catchment area in question. Stream gaugings are rarely available, and local records, if kept at all, are of little assistance in arriving at the actual supply to be reckoned upon. The population (unless the boundaries of the area of supply are coterminous with the town or parish) can only be approximately ascertained, and even the consumption per head has to be roughly estimated from measurements taken at uncertain, and often irregular, intervals by the foreman in charge. The flow of water through filters is often regulated by hand, and no records kept of the varying speeds. With such imperfect information engineers cannot possibly give reliable advice, and it is not surprising, therefore, that under such circumstances their opinions sometimes differ, and keen controversy arises.

In urging the necessity for compelling water authorities to keep complete records, it may reasonably be asked that the nature of the returns should be stated. The author, therefore, will call attention to a few of the principal items which should be furnished annually.

POPULATION.

It is very important to have an accurate estimate not only of the population of the catchment area, but also of the inhabitants supplied with water. When the area is coterminous with the boundaries of a city, county, town, district, or parish, the census returns can be accepted for the total population, except in the cases of holiday resorts, where it fluctuates considerably. The population actually supplied can be ascertained by multiplying the total number of services by either $4\frac{1}{2}$ or 5 as the average number of persons in each house. When the population supplied is actually less than the estimate, the consumption per head per day consequently appears to be less than it is, and *vice versâ*. Thus, on a shortage of water occurring, the water authority may be advised to proceed with a needless extension of the works; whereas, if the waste had been revealed and reduced, the outlay on extensions would have been unnecessary—at least, for some time. Under this head, it is worth noting that, in terms of the Census Act of 1910, the Registrar-General is empowered to furnish abstracts of statistical information derivable from the

census reports to any local authority or person requiring and willing to pay for them.

Rainfall.

The central authority charged with the collection and tabulation of statistics should be empowered to fix the number and position of rain gauges within the catchment area of each water authority, having regard not only to local, but also to national, requirements. It is only since the year 1860 that regular rainfall returns have been collected and published. Consequently some very wild estimates have sometimes been made as to the quantity of water available in different watersheds; and in many of the earlier parliamentary contests the quantity of compensation water was fixed at such a high figure that much useless expenditure has been imposed on the towns in question. Such results would have been avoided had correct information as to rainfall or "run-off" been available. It is amazing how many water authorities are even now without the means of keeping an accurate record of the rainfall within their catchment areas.

Streams.

In a similar manner the central authority should fix the number and position of gauges in the streams. These records would be of even more value than the rainfall statistics, as they would directly indicate the run-off from each watershed.*

Reservoirs.

Constant records should be kept of the quantity of water in store at regular intervals. It is very important that, whenever the amount in store falls so low that proper sedimentation cannot be secured, special means should be adopted to purify such imperfectly stored water, either by increased attention to filtration or by chemical treatment. The beneficial results of storing water for a certain number of days have been very clearly demonstrated by the research work of Dr. Houston and others.

Filters.

In Dr. R. C. Reece's exhaustive report to the Local Government Board on the epidemic of enteric fever in the city of Lincoln, 1904-05, he states that:

> No systematic or written records have been kept at the Lincoln Water-Works as to the number of gallons of water entering the water-works from the various sources of supply, nor of the number of gallons of water pumped to the town, nor the date on which filter-beds have been put out of action for cleansing purposes. The water-works have no automatic mechanism for recording the amount of water entering the works or passing through individual filter-beds, nor any means of controlling the rate of filtration except by the closing or opening of sluice valves by workmen. . . . I found it impossible to obtain, with any approach to accuracy, information on the above points, owing to the absence of any written records.

As a result of Dr. Reece's valuable recommendations, the Lincoln Corporation soon afterwards fitted up suitable appliances for the purposes mentioned. Records should be kept of the working of all sand and mechanical filters, and the appliances designed so that the speed should not exceed a certain flow, to be fixed as the result of careful bacteriological examination of the particular water at different periods.

Distribution.

The water leaving each service reservoir should always be measured before it reaches the consumers. In this manner the amount consumed per head can be accurately obtained, provided the population is correctly estimated. When the area of supply has been divided into suitable districts, with a waste-detecting meter to control each section, and stringent bye-laws regarding the construction and maintenance of water-fittings enforced—involving, of course, a regular house-to-house inspection—an immense amount of water may be saved at relatively small cost. A thorough inspection, regularly undertaken, of pipes and water-fittings in all houses and other premises may involve an increase in the staff of inspectors; but in many cases it has been found, apart from the substantial saving of water, that the increased revenue resulting from the discovery of chargeable items has more than repaid the additional expenditure incurred.

It must also be noted that when undue waste of water exists, the delivery to the higher parts of the districts may be intermittent; and it has been found in many instances more economical to prevent waste than to incur the cost of laying larger mains. Another interesting question, which ought to be more often considered, is as to the time when the supply to large consumers—*e.g.*, public works—can best be given, so as to equalize the demand as far as possible. In this connection, the author recently advised his Board to give a reduced rate to large consumers who would undertake to draw their supplies when the mains were otherwise not much used. Finally, the central authority should be empowered to see that the amount of water delivered in each district should not exceed a certain quantity, to be fixed after the local conditions are considered in each case.

Finance.

The financial statements should be prepared on a prescribed basis from which an analytical working statement could be constructed, giving the proportionate cost of the different items of expenditure per 100,000 gallons of water sold, and the income derived from the various classes of houses, or some other convenient unit of calculation. The published statistics should also include the different rates chargeable and those actually charged. This information would tend to bring about a much-needed uniformity in the rates of charge for water supplies. There are very few, if any, districts with the same scale of rates; and it would be a difficult matter to explain the basis upon which some charges have been fixed.

The headings for the statement of working charges might include the annual amounts paid for

1.—Interest on capital.
2.—Sinking-fund instalments.
3.—Mortgages and loans.
4.—Rents and taxes.
5.—Maintenance of works, subdivided into (*a*) gathering ground; (*b*) reservoirs; (*c*) filters; (*d*) pumping; (*e*) renewal and repairs of pipes; (*f*) general inspection; and (*g*) law charges.
6.—Salaries.
7.—Total wages.
8.—Miscellaneous.

The author trusts he has sufficiently explained the necessity for making the keeping of statistical records of water undertakings compulsory; but to those among us who are directly concerned with particular undertakings, such statistics would be of the greatest value, as enabling us to compare one year with another, and thereby ascertain at a glance the points where improvements might be effected. Comparison with returns from other similar undertakings would accomplish the same end even more effectively; and after a period of years, such records, particularly of our larger concerns, if collected and scientifically tabulated by a central authority, would afford most valuable information, and inevitably lead to the development and control on broader lines of the entire water supply of the nation. The author therefore considers that water engineers should be the first to advocate the introduction of legislation to make the keeping of records on a common basis compulsory upon all water undertakings.

DISCUSSION.

The President (Mr. C. Clemesha Smith, of Wakefield), said he was in accord with the author as to the necessity of keeping statistical records. Indeed, this was an extremely important part of a water engineer's duty; and unless it was efficiently performed, the engineer could not be in a position to give sound advice to his authority or company. He believed that there were few engineers who were not fully alive to these facts, and that in most undertakings complete records were being kept. The question of compulsory statistical returns formed part of the larger question of the control of the water supplies of the country, and was the foundation upon which efficient control must rest. The Institution had for a long time past been alive to the importance of the matter under discussion. At the general meeting held in December, 1900, a report was presented by the Water Boards Committee dealing with some of the most important defects of the system of water supply. In the course of the report it was stated that the collection and publication of official returns relating to existing undertakings was much to be desired. "In this respect," it was added, "this country was far behind others. It was obviously impossible to secure complete and reliable returns of the whole of the water-works undertakings in the country unless such returns were required compulsorily." Until official returns were forthcoming, the Committee thought that the Association itself might make some attempt to collect data. A resolution was passed to the effect that the Association should endeavour to organize the systematic collection of data. A form for the purpose was drafted, and circulated among the members. Subsequently the work was taken up among the water undertakings throughout the country by Messrs. Hazell, Watson, and Viney, in connection with their "Water-Works Directory;" the scope and value of which was thereby greatly increased. Valuable as this directory was, it was obvious that compulsory returns collected and collated by a committee of experts on a uniform and comparable basis must necessarily be more valuable than a series of voluntary returns varying in form and detail. The report of the Water Areas and Statistics Committee of the Institution, in 1911, dealt at some length with the organization of local and central control. It stated, *inter alia*: "As the information relative to the national water resources would be of a highly technical nature, it is our opinion that the collection and collation of the returns should be placed in the hands of experts." The Institution had not lost sight of this important subject. He (the President) considered that it was imperative that the water supply of the country should be more closely organized. As long as the various water undertakings remained more or less isolated units, drawing water from sources wholly apart and greatly in excess of requirements, each might be a law unto itself without harm to others. But the growing needs of the country had to be met from inelastic resources. The expansion of population rendered cities villages, and rural areas more and more dependent on one another, and often created a conflict of interests regarding the allocation of supplies. It was therefore important in future to avoid the many difficulties which had been created by haphazard methods in the past. This was only possible by better organization of their resources, and, as he previously stated, the only reliable basis on

* See "Gauging and Recording the Flow of Streams," by S. C. Chapman. "Journal," Vol. CXII., p. 857.

which efficient organization could rest was to be supplied by accurate and uniform statistical returns.

Mr. E. ANTONY LEES (Birmingham) thought that broadly Mr. Chisholm had dealt very well with the subject of his paper. On the whole, however, he (Mr. Lees) very much doubted whether the case was quite so bad as the author stated. For instance, in some cases water engineers did prepare annual reports and so on; and he apprehended that it would be more correct to say that in some cases water engineers "did not" prepare annual reports. Undoubtedly, the generality did prepare sufficient statistics. The point, however, was that they should be arranged in such a way that they were comparable for all useful purposes. But they would never all be able to keep their returns in precisely the same manner. The circumstances of different undertakings varied so widely that any uniform method would be absolutely impossible. In his paper, Mr. Chisholm suggested uniformity in rates of charge for water supply. In reading he wisely inserted the word "special" before the word "rates." It was absolutely impossible that there should be uniform charge. In view of the infinite diversity of capital and administration costs, any uniformity of charges would be out of the question. If Mr. Chisholm meant, as he probably did, that there should be uniformity of "principle" of charge—that certain special uses should be charged under a given proportion of the standard charge—then probably most of them would agree with him. There were details, too, that had a very important bearing on this subject. For instance, there was the question as to population. In the case of large authorities at any rate, it was misleading to divide the water distributed over the population either at the beginning or at the end of the period. They had so many gallons distributed in twelve months, and to divide this by the population at the beginning or the end of the period was wrong, as what they wanted was the average of the population for the year. What he did was to take the number of houses in occupation at the beginning of the year, and the number at the end of the year. He then obtained an average of the houses in occupation for the year. This average he multiplied by a unit found by experience to apply to the average occupants of the houses, and so he arrived at the average population of the year. This he used to divide the total quantity of water distributed to find the amount supplied per head of the population. He thought that his method of arriving at the population gave one a reasonably safe average, to show progress from year to year, and to obtain knowledge as to the consumption per head per day. As to the rainfall, it was not sufficient to establish so many gauges on the watershed, and add the records of these gauges together, and divide the result by the number of gauges. This by no means gave the average fall over the area. They knew that the highest falls were often very restricted in area; and, according to the configuration of the watershed, so the area governed by each rain-gauge was determined. It was consequently necessary, in order to get at a true estimation of the rainfall, to have some means of determining the area to which each rain-gauge applied.

Mr. S. C. CHAPMAN (Torquay) remarked that it would be a very difficult thing for him to make a return as to the population supplied. In his town, they had a normal resident population. But they had two seasons—a winter season from January to after Easter, and a summer season, from July to the end of September, when the town was full to overflowing. It was therefore impossible for him to make any return as to the average population over the whole year. He also spoke of the difference in the density of population in different areas of a water-supply district, to show that one figure per house for the occupants would not apply. As to the question of returns as to rainfall, streams, &c., he thought this was very important, and that such returns should be made compulsory. The reasons were very simple. They, as water authorities, had to keep their eyes wide open for extensions; and they all knew that, when they applied to Parliament for powers, there was all sorts of opposition put up against them from landowners, fishery boards, millowners, and so on, and each and every one wanted compensation. As a consequence, in one way or another, very often undertakings had settled upon them obligations with regard to compensation they ought never to have had to bear. The keeping of complete and careful statistics by some central body would be a relief to every water undertaking, and fairer and more even treatment would be awarded when they had Bills in Parliament.

Mr. HAROLD W. WOODALL (Bournemouth) said that personally he was opposed, under ordinary circumstances, to any more compulsory returns than one could avoid; but he thought Mr. Chapman had given them a valuable reason for considering this question most carefully. What was before them that day was not a question of detail, but a broad principle as to whether or not there should be a compulsory return. Upon questions of detail, they could talk for a very long time. It seemed to him that Mr. Chapman had hit on the *crux* of the whole thing. When a water company had to go to Parliament in these days, they had heavy responsibilities placed upon them to maintain the supply of water; but, when there, they were treated as nothing better than thieves and robbers, or, at any rate, as if they were trying to gain something for themselves in opposition to the public. If there were some central authority in control of everybody with water rights, they would all be in a much better position.

Mr. C. H. ROBERTS (Aberdeen) remarked that the case for compulsory returns on many subjects had been made out more than once. Mr. Chapman had mentioned the question of population, and how reports might be very misleading. There was the case of Southampton. There the Corporation supplied the borough with water, while a Company supplied the suburbs. The borough was a trading centre; and it was flooded with people in the daytime. But when the day's work was over, the people went away into the suburbs, and then took water from the Company. Therefore, no return that did not take into account the enormous influx of people from the suburbs during the day (who were not counted in the night population) would be accurate. In the annual statistics that were published, he thought a distinction might be made as to the unmeasured water and the measured. But as a great many trade purposes were supplied—as in the case of domestic supply—on the rateable value, while others were supplied by meter, if they started to separate the domestic from the trade supply, he was afraid they would soon fall into difficulties. Gas and electric supply were different—being sold by measure.

Mr. C. H. PRIESTLEY (Cardiff) believed that in certain instances Government returns would be an advantage; but there were certain portions of the paper with which he did not agree. He should like to emphasize what Mr. Antony Lees had said with regard to uniformity of the rates for water supplies. He might mention a rather large town near to his own, where the water supply for trading purposes was down as low as 1d. to 2d. per 1000 gallons. In this town, he believed they made a profit. In Cardiff, the lowest scale (which was similar to the scale in many large towns) was 6d. per 1000 gallons, while the average cost of the water was upwards of 8d. per 1000 gallons.

Mr. W. T. BURGESS, F.I.C. (London), said the fundamental record for water engineers had reference to rainfall. If one wanted to look up a district to find out the average rainfall, there was but one source of information—the volumes of the British Rainfall Association. But these records were mostly voluntary ones. This brought home to them that the records were not taken at absolutely permanent stations. Looking at the matter from the point of view of the water-works engineer, this was not altogether satisfactory; and so it appeared to him that every water undertaking ought to keep its own records of rainfall.

Mr. CHISHOLM, in reply, said that the paper was prepared when he found out that in some cases, particularly small water undertakings, records were not kept and even in the case of some of the larger undertakings, there were some who did not have formal reports prepared. Others did prepare very elaborate returns and very useful information. In keeping statistics, the longer the period became, the greater their value for everybody—not only for commercial purposes, but for the local authority and the officials. But supposing the official kept records only for his own use, he (Mr. Chisholm) held that this was not as things should be. The figures should be tabulated in some form each year, and be submitted to the water authority, and, if possible, circulated among the different water authorities, so that the statistics could be compared with neighbouring works. Then a useful purpose would be served. Mr. Lees had mentioned the impossibility of uniformity of rates. This was not in his (Mr. Chisholm's) mind; but, as he had said, he intended to refer to special charges. It was impossible, of course, to get uniform charge for meter supplies from all over the country. Circumstances differed. But it seemed to him there should be some relation between meter charges and domestic charges, and special charges. He hoped that water statistics would be kept by a public authority, that they would be made compulsory, and that they would be tabulated by an expert. For their good as water engineers, and as members of the Institution, and from the national point of view, this was desirable.

Hydraulic Transport of Coal.—The Hammersmith Borough Council have now formally adopted the scheme [to which reference has been made in the "JOURNAL"] of Mr. G. G. Bell, their Electrical Engineer, for pumping coal from the riverside wharf to the electricity works, and there storing it in five huge tanks capable of holding 6000 tons. The cost of the necessary plant will be £15,600; but it is anticipated that, as against the charges in connection with the necessary loan, the following annual saving may be effected: By pumping 18,000 tons, £540; by permanent and casual labour at the coal yard, £120; estimated annual saving in depreciation of coal, on basis of coal consumption required for the production of 11 million units, £917—total, £1577. Among the tenders accepted, subject to sanction being received for borrowing the capital sums required to carry out the scheme, is one by the British Mannesmann Tube Company for so much of the pipe erecting as may be required.

The Lighting of Schools.—In a letter to the "Manchester Guardian," Mr. Daniel H. Ogley, of the Royal Technical Institute, Salford, pleads for the better lighting of schools, and urges that Government aid to enable an exhaustive inquiry to be made into the whole question of school lighting is urgently needed, as individual effort fails in the end through lack of sufficient support. "School lighting," he says, "since it is in their school days that children are in the most easily influenced stage of their development, needs special attention; and one cannot help but feel that the contractor with the rule-of-thumb methods should now be banished, and his place taken by the expert, before further damage is done. If in addition to the examination of the children the school were also examined, and the effects of the light-units carefully studied, much more good would undoubtedly result on the removal of the cause of the mischief. It is quite easy to arrange for adequate illumination, although a departure from the recognized standards is to many people, no doubt, a crime."

AUTOMATIC GAS-SAMPLING APPARATUS.

The current issue of the "Journal of the Society of Chemical Industry" contains the text of a paper read before the Scottish Section by Dr. THOMAS GRAY, in which he describes an automatic gas-sampling apparatus, and offers some observations on sampling. It is as follows:

The operation of taking a sample of gas over a period of some hours, which is frequently carried out during tests of efficiency of combustion and of gas production, is seldom conducted with sufficient care to ensure accuracy. According to the method most commonly employed, a bottle or sampling-tube, filled with mercury, water, or an aqueous solution of glycerine or of magnesium chloride, is connected to the gas supply, and the liquid is allowed to run from the bottle; the rate of flow being regulated by means of a stopcock or screw-clip, so that the gas enters the bottle at a uniform rate during the whole period of the test. If mercury is used as the confining liquid, the alteration of pressure caused by the falling level necessitates constant attention to the adjustment of the rate of flow, in order to secure even approximately uniform sampling; and this regulation is generally not sufficiently accurate to ensure good results.

Making use of the well-known principle of the Mariotte bottle, Mr. G. N. Huntly has devised a simple gas-sampling tube, from which the flow of mercury will take place uniformly. The only drawback to the use of this apparatus—probably a trifling one in practice—is the difficulty of setting the stopcock initially, so that the desired volume of gas will be collected during the period of sampling. If any liquid other than mercury is used, the variation of the suction as the level falls is less serious, and regulation of the rate of flow consequently presents less difficulty. But a new error is introduced by the solvent action on the gas, particularly if a large proportion of carbon dioxide is present.

It is commonly assumed that concentrated aqueous solutions of glycerine and of magnesium chloride have no appreciable solvent action on the ordinary industrial gases; but while this statement may be accepted for short periods of contact, considerable alteration of composition may take place if the gas is allowed to stand for some hours in contact with these solutions, particularly if it is shaken with the confining liquid. With the object of determining the magnitude of this error, a mixture of air and carbon dioxide, containing between 11 and 12 per cent. of the latter gas—a proportion frequently found in flue gas—was confined over aqueous solutions of glycerine and magnesium chloride for varying periods, and subsequently analyzed. The solutions were prepared by dissolving pure glycerine and crystallized magnesium chloride in water, in the proportions of one part by weight to one part of water and two parts to one of water. The stronger solution of magnesium chloride was saturated at ordinary temperatures, and the more concentrated glycerine solution contained the maximum proportion of glycerine which could be conveniently employed, on account of the high viscosity and consequent slow rate of movement through the capillary tubes of the sampling apparatus.

Ordinary gas-sampling tubes, attached to reservoirs, were filled with the solutions; the gas was passed into these till the tubes were half full, taking care to avoid shaking; and they were then allowed to stand at room temperature for the stated periods. In one test, with the more concentrated solution in each case, the gas was vigorously shaken with its own volume of the confining liquid for five minutes. Results of the analyses appear in Tables I. and II.

TABLE I.—*Composition of a Gaseous Mixture, confined over Aqueous Solutions of One Part of Magnesium Chloride in One Part of Water, and of One Part of Glycerine in One Part of Water, by Weight.*

[Sp. gr. of magnesium chloride solution 1·213, of glycerine solution 1·128, at 15° C.]

—	Temp. of Solution.	CO_2.	O_2.	N_2.
	Deg. C.			
Composition of the original gas .	..	11·42	6·69	81·89
After half hour over magnesium chloride solution	20	11·29	6·72	81·99
Do., over glycerine solution . .	21	11·24	6·73	82·03
After one hour over magnesium chloride solution	20·5	11·21	6·73	82·06
Do., over glycerine solution . .	22	11·17	6·75	82·08
After 24 hours over magnesium chloride solution	20	9·32	6 95	83·73
Do., over glycerine solution . .	19	7·86	7·16	84·98

An examination of the results shows that the composition of the gas was not seriously affected by contact for one hour with any of the solutions, and that the change was practically negligible, even after standing for 24 hours over the more concentrated solution of magnesium chloride. On the other hand, shaking the gas with the solutions, and simple contact with the more dilute solutions for a period of 24 hours, caused a very decided alteration of the composition. The magnesium chloride solution shows a distinct advantage over the glycerine solution of the same strength; but against this must be set the tendency to crystallize at low temperatures, from which the glycerine is free. The results

TABLE II.—*Composition of a Gaseous Mixture, confined over Solutions of Two Parts of Magnesium Chloride in One Part of Water, and of Two Parts of Glycerine in One Part of Water, by Weight.*

[Sp. gr. of magnesium chloride solution 1·292, of glycerine solution 1·173, at 15° C.]

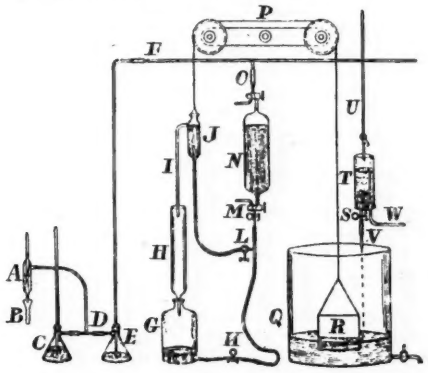
—	Temp. of Solution.	CO_2.	O_2.	N_2.
	Deg. C.			
Composition of the original gas .	..	11·42	6·69	81·89
After half hour over magnesium chloride solution	16·5	11·36	6·74	81·90
Do. over glycerine solution . .	17·0	11·32	6·75	81·93
After one hour over magnesium chloride solution	16·5	11·32	6·74	81·94
Do. over glycerine solution . .	16·5	11·23	6·78	81·99
After 24 hours over magnesium chloride solution	15·5	11·13	6·75	82·12
Do. over glycerine solution . .	15·5	10·51	6·81	82·68
After five minutes' shaking with its own volume of magnesium chloride solution	17·0	9·73	6 92	83·35
Do. with own volume of glycerine solution	17·0	7·61	7·18	85·21

indicate that the ordinary industrial gaseous fuels and the products of their combustion may be stored for short periods over the more concentrated solutions of glycerine and magnesium chloride without fear of any considerable change of composition, but that prolonged contact and agitation with the confining liquid should be avoided.

If the results of the analysis of a gas are required for the estimation of the efficiency of gas production or of the heat losses in flue gas, it is desirable to exclude all possibility of any alteration of composition, by using mercury as the confining liquid. The volume of gas V produced from one kilogramme of coal is usually calculated with the help of the equation:

$$V = \frac{C}{(M+K+K_1)\ 0{\cdot}536 + \frac{S}{10}}$$

where C is the weight of carbon gasified per 100 kilos of coal, S is the number of grammes of free carbon per cubic metre of gas, and M, K, and K_1 are the percentages of methane, carbon dioxide, and carbon monoxide in the average sample of the gas. It is evident that any considerable error in the value of K will have a serious influence on the result, especially in the case of a flue gas, the gaseous carbon compounds of which consist almost entirely of carbon dioxide. The difficulty of handling large volumes of mercury, on account of its high specific gravity, practically precludes its employment in many cases; but provided the sampling proceeds sufficiently regularly, a sample of relatively small volume may be assumed to represent the bulk.



With the object of securing an average sample of gas, taken at a uniform rate, over any specified period which may be varied at will, the author constructed the apparatus illustrated in the accompanying diagram. In designing it, the desirability of using only such appliances as are available in an ordinary chemical laboratory was kept in view. It consists essentially of an ordinary gas-sampling tube N, which may be filled with mercury from the bottle G, attached to a reservoir J, which is counterpoised by a vessel R, floating in water in a tank Q; the float being connected with J by means of a cord which passes over the pulleys P. The float may be a tinned-iron vessel or a glass bottle containing the necessary quantity of water or lead shot to establish the balance. The height of the tank must be greater than the length of the tube N, the overflow-tube I should be slightly longer than N, and the length of the wider tube H, which merely serves to prevent loss of mercury by splashing, should slightly exceed that of I.

The jet V, under a pressure which may be regulated by adjustment of the overflow W, through which the excess of water from U escapes to waste, delivers sufficient water during the specified period to raise the level in the tank to a height equal to the length of the sampling-tube. As the water-level rises, the reservoir J is steadily lowered, drawing the gas uniformly into the tube N; and the mercury thus displaced escapes through the overflow

tube to the bottle G. By means of a suction pump A, which discharges into the drain-pipe B, a rapid current of gas is drawn along the tube F, which is connected to the flue or the gas-main; a suitable filter being interposed, if necessary, in order to retain any solid particles. The connection O between the sampler and the tube F is preferably made of capillary tubing from 3 to 4 inches long, to prevent the diffusion of gas backwards from N into F. If desired, a small non-return mercury-valve may be inserted at this point. The flasks C and E serve to indicate that the gas is passing freely along the tube F, and at the same time act as a safety-valve. So long as the tube F remains clear, the gas passes through E; but if an obstruction occurs, air is drawn through the bottle C, thus preventing the pump from drawing the mercury out of the sampling-tube and discharging it into the drain.

To start the apparatus, the tube F is connected with the gas supply, and a rapid current of gas is drawn through F by means of the filter pump. The rubber tube connecting the jet V with the water supply is then closed by the clip S, and water is allowed to run into T, and to overflow freely through W, the height of which has previously been adjusted to the desired level. Water is now run from the tank Q till the top of the tube I is at the level of the shoulder of the tube N (it is desirable to use sampling-tubes with square shoulders in place of the customary rounded ones). J and N are now filled with mercury by raising the bottle G, after which the clip K is closed, and the bottle replaced in the position shown. The capillary O is finally filled with mercury by raising the reservoir J, the lower stopcock of the sampling tube is closed, and J is then lowered to its former position. The sampling-tube and the capillary O are at this stage completely filled with mercury, J is filled to the overflow-tube, which is level with the point where the capillary joins the shoulder of the tube N, and the operation of sampling may now be commenced by opening the lower stopcock of the tube N and starting the flow of water from the jet by slipping the clip S up the glass tube into the position shown in the diagram. The suction-pump and the water supply to T remain in operation during the whole period of the test, and the apparatus requires no further attention.

The period of sampling may be varied in a number of different ways: (1) Jets may be constructed to deliver the requisite quantity of water in the specified times. These are easily drawn from glass tubing in a blowpipe frame; the final adjustment being effected by altering the head of water in T. (2) Tanks of various diameters may be employed. (3) The height of the tube N may be varied. (4) Two or more sampling-tubes may be attached at different points to the tube F, and by means of T-tubes to J and G; these being used in rotation. In one of these ways, or by a combination of them, the operation of the apparatus over any period may be arranged for.

In an alternative form of the apparatus the water-tank and float are replaced by a cheap clock, of the form operated by a falling weight; the mercury reservoir taking the place of the weight. In this case it is desirable to close the bottom of the reservoir with a doubly bored cork, and pass the overflow-tube through one of the perforations instead of sealing it into the side as shown. The adjustment of the volume of mercury to correspond with the original clock-weight is then easily effected by raising or lowering the overflow; but if a reservoir with a sealed-in tube is employed, the necessary balance may be established by an alteration of the weight of the pendulum bob.

A stop is fixed on the chain of the clock, so that when the reservoir is pulled up into the highest position, the top of the overflow-tube is on the level of the point where the capillary joins the shoulder of the tube N. When in this position, the apparatus is filled with mercury from the bottle G, the lower stopcock of the gas-tube and the clip K are closed, and G is replaced. The stopcock may then be opened, and the apparatus set in operation by starting the pendulum.

This form of the sampling apparatus, while more compact than the one previously described, lacks the flexibility of the other. A limited amount of regulation is possible by moving the bob of the pendulum. Larger variations of the period of sampling may be arranged by gearing, by increasing the length of the sampling-tube, or by connecting two or more tubes, as explained.

Both forms of the apparatus have been in regular use for several years, and have proved highly satisfactory.

CORROSION AND RUSTING OF IRON.

This was the subject of a paper read by Mr. Eric K. Rideal at the meeting of the Society of Engineers on Monday, the 1st inst. The author is a supporter of the electrolytic theory of corrosion, and believes it to be perfectly tenable when due attention is paid to considerations such as alterations in the solution pressures on crystal surfaces, and to the phenomenon of passivity exhibited by this metal.

Mr. Rideal showed that corrosion is due either to internally generated electric currents or to those from external sources. The theory is applicable to the problems of rusting in ferro-concrete, water-pipes, and structural ironwork, as well as to the action of stray currents from tram-rails, damp electric light leads, and telephone cables. In the light of this theory, plating iron with metals, or covering the surfaces with paints and varnishes, are to be regarded as means to an end—viz., to prevent the formation of local "corrosion cells."

Water-pipes are exposed to both internal and external attack. For small pipes, cast or wrought iron is suitable; but for larger pipes weight has to be considered, and steel is used. For thin steel pipes, it is obvious that, if corrosion once set in, bursting would occur. The practice of laying water-pipes with gas and electric mains in a common tunnel seemed to the author worthy of greater attention than it receives. Surface waters containing relatively large amounts of carbon dioxide and oxygen rapidly corrode ironwork; while rusting is accentuated if the water is very soft. A small quantity of lime added to such waters is a useful antidote, and its value has for long been overlooked.

The phenomenon of "pitting" in steel pipes, and the use of zinc, tin, copper, lead, paints, and varnishes for protecting exposed metallic surfaces was dealt with. In this connection it was pointed out that zinc possesses one great advantage—it forms a solid solution with iron. Dipping iron into zinc ensures a perfectly uniform skin. One of the best rust-preventers consists of a mixture of tar and hydrocarbon oil applied to the cleaned and heated surface of the metal.

In conclusion, the author expressed the opinion that the various methods of testing corrodibility are all open to criticism; and he said the effect of additions to pure iron have not been sufficiently well investigated for any definite conclusions on the subject to be drawn.

THE NAPHTHALENE PROBLEM IN AMERICA.

Investigation by the American Gas Institute.

The members of the American Gas Institute were some time ago requested by a Sub-Committee of the Technical Committee to name subjects for investigation which would be of general and prominent interest; and a number of them suggested naphthalene. The Sub-Committee accordingly took it up, and framed a set of twenty-nine questions fully covering the matter. Copies were sent to sixteen gas companies with a request that they should be kindly replied to. Only nine, however, responded; but in some cases the information furnished by them was fuller than had been specified in the questions. The replies included returns from two hand-charged horizontal stop-end retort plants (Works "F" and "H"), two machine-charged ditto (Works "A" and "E"), a vertical retort plant ("D"), a chamber-oven plant ("G"), an inclined retort plant ("I"), a machine-charged through-retort plant ("I"), and two coke-oven plants ("B" and "C"). Consequently, all the different methods of making coal gas in use at the present time were represented. The returns were duly tabulated, and presented to the members of the Institute at the recent annual meeting in a report by the Sub-Committee, of which Mr. H. L. Underhill was Chairman. The returns are too long for reproduction, as they occupy 21 pages of the Institute's "Transactions;" but their nature may be gathered from the Sub-Committee's observations upon them, which are as follows.

Naphthalene Production with Various Settings.

From a study of these returns, it appears that more or less naphthalene is made at all the works referred to and at all times. It cannot very well be otherwise, considering the heats which are carried, running from 1850° to 2200° Fahr., except at one of the coke-oven plants. There the gas production is carried on in two distinct periods—the rich-gas and the lean-gas run. During the first period, the gas leaves the oven at 1200° Fahr., and no naphthalene is produced—atleast none is observed. During the following lean-gas period, the temperature runs up to 1500° Fahr., and naphthalene is made and in evidence. Unfortunately no quantitative tests for it are reported; but it stands to reason that, when it is produced to a certain extent at this comparatively low temperature, it certainly is made at the other plants working off smaller charges with much higher heats. Three other works test for it, and report in crude gas (per 1000 cubic feet):

Works "D" (vertical retort plant), 204 grains; "F" (horizontal short retort plant), 926 grains; "G" (chamber oven plant), 163 grains.

The two works "D" and "G" produce a crude gas with a remarkably low content of naphthalene. For this reason perhaps neither of them employs any naphthalene extracting apparatus, each relying on its own tar to absorb it. If the returns are correct, there is, however, a wide divergence in the naphthalene contents of the tars from these two works—"D" reporting only 375 grains and "G" 4·239 lbs., or 29,673 grains, of it in the tar obtained from 2240 lbs. of coal. The tar from "D" works is practically free from naphthalene, containing only a small fraction of 1 per cent. of its own weight, and is thus as efficient a solvent for what is left in the gas as a water-gas tar made at low heat. Even the tar from "G" is well under what is considered normal in ordinary good tar of about 1·16 sp. gr., which may contain from 5 to 10 per cent. of its weight, or from 6·5 to 13 lbs. of naphthalene in the product of 2240 lbs. of coal. Hence the tar from "G" should still have some capacity for extracting naphthalene.

The tars both from the inclines and the horizontal retorts of plant "I" are much richer in naphthalene—containing respectively 7·62 and 9·10 lbs. of it. According to the returns received from this plant, it cannot be judged how much of this compara-

tively heavy content of naphthalene originates in the hydraulic main and how much has been added by absorption from the gas in the apparatus up to the naphthalene washers. The only figures for naphthalene in the gas given refer doubtless to the finished, not to the crude, article. These works, however, report no naphthalene stoppages in apparatus or connections, though in their case the naphthalene extractors stand much farther back in the sequence of apparatus than elsewhere, and the gas is cooled to a much lower degree before arriving there than in any other instance. Judging from these facts, it would appear as if the tar from both systems at works "I" were of a nature to absorb and carry what naphthalene is precipitated in the condensing, &c., apparatus.

The returns seem to point out that the works employing comparatively light charges of short duration are the principal producers of naphthalene. It is well to bear this in mind when contemplating the building of a new plant.

The conditions shown regarding hydraulic mains, the temperature in them, character of seals, dip-pipes, &c., do not point out anything novel or instructive. We may call attention to the unusually low temperature prevailing in the hydraulic mains of the inclined retort system at "I" [124° Fahr.]. The two coke plants and the vertical retort-house ("D") work without seals; and they do not seem to suffer from this feature so far as naphthalene is concerned.

The condensing apparatus used, as far as described, belongs to two types—the well-known multitubular water-cooled condenser, and the cataract washer cooler, which acts like a shower bath, reducing the temperature and at the same time washing out any tar, ammonia, or naphthalene deposited on the trays. Either apparatus can be made to do the work required; but the latter type has the advantage that it practically purges itself; while the tubular condenser may from time to time have to be bye-passed and cleaned by hand.

Extracting the Naphthalene.

Three of the works reporting employ naphthalene extracting washers or scrubbers. Two of them are of about the same pattern—steel cylinders fitted with horizontal trays over which the solvent is pumped and made to descend while the gas ascends. At Works "I" they make use of some compartments of rotary washers, other compartments being in use for different purposes. The solvent is the same in every instance—viz., water-gas tar. The figures given for the quantities of solvent used and the naphthalene in it, when first introduced and when discarded, vary. Works "E" used 0·14 gallon of it per 1000 cubic feet passed; "F" quotes 0·25 gallon; while "I" reports 0·05 gallon for the inclined plant and 0·072 gallon for the horizontals. "E" has no data showing how much naphthalene is extracted; "F" gives 7 per cent. before using and 25 per cent. of naphthalene content of solvent after discarding it; while at "I" they are using a tar practically free from naphthalene, but containing 7·75 per cent. and 11·29 per cent. for the inclines and horizontals respectively when discarded.

Of course, not every water-gas tar is equally serviceable for this extracting business; and some tars may be so loaded up with naphthalene themselves as to be of little or no value. Experiments made abroad, and quoted in the "Journal of Gas Lighting" for Aug. 27, 1912, show that, when the temperature of the superheater of a water-gas set ran above 1380° Fahr., the naphthalene contents of the tar increased rapidly, reaching 40 per cent. with a temperature of 1510° Fahr. Other tests, also made abroad [see "Journal für Gasbeleuchtung," Feb. 17, 1912] go to show that when washing gas with pure anthracene oil much better absorption of naphthalene was obtained at lower than at higher temperatures. The same would very probably hold good for any other solvent, like water-gas tar.

The temperatures of naphthalene washers abroad seem to be maintained at from 65° to 68° Fahr., which also corresponds to the practice at Works "I." Works "E" reports a temperature at the inlet of the naphthalene washer of 105° Fahr.; and "F," one still higher—118° Fahr. Presumably the latter two works prefer to run at the higher temperatures to escape excessive cooling in the primary condensers, and the consequent stopping-up of them. But with these higher temperatures larger extractor capacity and more solvent will probably have to be used, because the latter will reach the practical point of saturation sooner than with the lower temperatures. The efficiency of the washers might be increased by cooling the water-gas tar in circulation. The effect of the cold solvent upon the warmer gas would be to create a tar fog out of which the naphthalene could be more readily extracted. These points regarding naphthalene washers are well worth some further experiment and research.

The reply of Works "H" to question No. 23—"Do you make quantitative tests for naphthalene at the outlet of the condensing system, and what is found?"—is rather startling. There the naphthalene found at the outlet of the meters is given as follows: In coal gas, 0·154 to 0·231 grain per cubic foot (or an average of 190 grains per 1000 cubic feet); in water gas, 0·269 to 0·339 grain per cubic foot (or an average of 305 grains per 1000 cubic feet). Since the works make 20 per cent. of coal and 80 per cent. of water gas, this means an average load of 282 grains per 1000 cubic feet of mixed gas leaving the works, unless some of it is dropped in the holders; and yet they report no naphthalene disturbances in the district. The reports from works "I" indicate an average content of naphthalene at the station-meter outlet of 97 grains, with a maximum of about 250 grains per 1000 cubic feet of gas passed. No trouble in the distributing system is reported, probably because of the benevolent influence of the water gas in the mixture.

In the replies to question No. 16, as to the method of removing naphthalene stoppages, several of the officials of the works state that they are cleared by the use of steam and gasoline. It would seem appropriate here to sound a note of warning regarding this practice. Steam, of course, melts the naphthalene crystals, since the fusion-point is about 178° Fahr. But you must be very sure of promptly and completely pumping or draining the resulting liquid from the main or apparatus. Gasoline also dissolves and floats off a naphthalene deposit; but, since its vapour tension is high, it soon evaporates, and leaves the naphthalene behind. In either case, it must be borne in mind that the recrystallized naphthalene is much more solid and hard than the original flakey deposit, and that eventually nothing will touch it except a steel bar. A copious stream of boiling hot water is preferable to steam, where it can be applied; and heavy oil of low vapour tension, like crude oil, is preferable to gasoline.

Hints on Laying-Out New Plant.

On the basis of a study of these returns, and with what is generally known of the subject, the following points applicable to the laying-out of a plant which is to steer clear of naphthalene difficulties would suggest themselves.

Select a system of carbonization in which the coal is treated in a way of exposing the gas once evolved to as little secondary heating as feasible. Chamber ovens, vertical retort benches, or long horizontal retort systems, which allow of full charges of sufficient duration to burn-off the coal thoroughly to ensure good yields, will be acceptable, and a selection from them will depend upon local conditions, cost of fuel, labour economy, &c.

Do all the condensing and cooling at the works. It is the most proper procedure in every respect, and will surely pay in the long run. Some naphthalene will be made with any method of carbonizing; but it should be, as nearly as possible, arrested at the works. Cool the gas to a degree as low as, or a little lower than, it will meet outside. Put in condensers of the best type and of ample capacity. Cataract washer-coolers, which not only cool by bringing the gas in direct contact with heavy showers of cold water, but also wash-out and remove what is being precipitated by such contact, appear to be very appropriate. The cooling liquid being in circulation soon becomes saturated with gas; and it can then be used in very large quantities without any fear of impoverishing the gas. This thorough cooling will incidentally have a very salutary influence upon the extraction of ammonia. By all means put in a naphthalene washer or scrubber of simple design. Water-gas tar is a product of most works, or it can be bought at reasonable cost. When saturated with naphthalene, it is at least as valuable as before. If water-gas tar cannot be had, fuel oil has been used to good advantage.

Naphthalene on the District.

With every care taken, a little naphthalene will escape beyond the confines of the works. Where a mixed coal and water gas is sent out, or where benzol enriching is practised, these few grains of naphthalene will easily be taken care of. Where coal gas is to be sent out straight, without enrichment, a final condenser at the outlet of the works might be taken into consideration. It is well known that gas free from moisture does not precipitate naphthalene. It does seem that the condensation of water gives the necessary shock for the formation of the naphthalene crystals. If we cool the gas sufficiently low to meet outside ground, &c., temperatures, we should practically remove all the water absorbed by the gas during its purification from water-seals and from gas-holder tanks, and have it carry moisture only according to the temperature to which it is cooled down. We should thus do away with condensation outside the works, at least to a very great extent, and also avoid naphthalene deposits. Incidentally, we could save money and annoyance by avoiding the pumping of drips and the clearing of pipes and meters.

Let us imagine the case of a large coal-gas plant, equipped like, and working under the conditions of, Works "I," and sending daily into a district 10 million cubic feet of straight unenriched coal gas. At the critical season of the year, the gas has been cooled down to (say) about 70° Fahr., and at this temperature the naphthalene has been extracted as far as feasible. But at the outlet of the station meters there is still found a naphthalene content of 250 grains per 1000 cubic feet, with a temperature of the gas of 85° Fahr. at that point. The gas there is fully saturated with aqueous vapour, taken up from the purifier seals, &c. It is not quite saturated with naphthalene vapour; but it will be when, during its travels through the district, the temperature is reduced to 70° Fahr., which is about the temperature of the soil at the ordinary depth of the mains, with lower degrees where they lie at greater depth, pass under watercourses, &c. The water of saturation above 70° Fahr. will all of it, or nearly all, be condensed; and its precipitation will, or may, cause some of the naphthalene to crystallize. The output of 10 million cubic feet contains some 2½ million grains, or 357 lbs. of it. One pound of flaky naphthalene crystals occupies the space of about 950 cubic inches. If only one-tenth of the whole content, or 35 lbs., of naphthalene should be crystalized, it would fill the space of 33,250 cubic inches, or nearly 20 cubic feet—certainly enough to cause quite an amount of trouble. Would not then a cooling

plant located at the outlet of the works, which would produce conditions like those met with in the district, be of great value?

Since collecting these data and writing these comments it has been suggested that the various works should have been asked to state the kind of coal used. This suggestion could not be complied with without delaying the report, and, at all events, we do not think that this item would have thrown much additional light upon the subject. One brand of coal may carbonize more freely than another, and should therefore be worked off with lower heats in the setting or in shorter charges of the same weight as the other less easily carbonizing coal, or in heavier charges of the same length, all with the view of not letting the temperature of carbonization get higher than a safe point, beyond which naphthalene would be produced to a much greater extent. Presumably all the works reporting had adjusted their heats and other working conditions to suit the brand of coal they were carbonizing.

TEMPERATURE OF A GAS-ENGINE CYLINDER.

Cyclical Changes.

At the Meeting of the Institution of Civil Engineers on the 16th inst., a paper was read on "Cyclical Changes of Temperature in a Gas-Engine Cylinder;" the authors being Professor E. G. Coker, D.Sc., and Mr. W. A. Scoble, B.Sc.

The authors gave an account of experimental work carried on during the last four years to determine the cyclical changes of temperature at the surface and in the walls of the cylinder of a gas-engine, and also the temperature cycle of the explosive charge itself. The engine used for the investigations was one of the National Gas-Engine Company's standard patterns, developing 12 I.H.P. at 240 revolutions per minute. The temperature distribution and the cyclical changes were measured by thermo-electric couples in all cases except at the middle of the cylinder wall, where this refinement was unnecessary. A special form of thermo-electric bridge was used to measure the electro-motive force of the couples; and by the inclusion in the circuit of a revolving contact maker the temperature was determined at any point of the cycle.

The surface metal temperatures and their cyclical changes were investigated at the centres of the inlet and exhaust valves, and at three points on a vertical diameter of the piston. Cast-iron plugs, with their faces turned very thin, were let in at these points, and iron wires led through and riveted on the face of the metal formed the couples. The highest temperature was recorded at the centre of the exhaust-valve. The maximum there was 400° C. The highest temperature at the inlet-valve was 310° C.; and at the centre of the piston, 340° C. The cyclical change was greatest at the centre of the piston, where it was 80° C. for one test with a medium mixture and cold jacket. This large range was principally due to low temperature at the commencement of the suction stroke. A richer mixture or warmer jacket eliminated this low temperature, and reduced the range to 40° C. or less.

Platinum-iridium and platinum-rhodium wires were used for couples to measure the temperatures of the gas in the cylinder. The wires were rolled to a thickness of rather less than 1000th of an inch, fused together electrically, rolled again, and trimmed to shape. The gas in the cylinder was sometimes at a temperature above the fusing-point of the thermo-couple, and therefore a very thin couple fused. Unless the couple was thin, it did not follow the cycle of temperature of the gas. It was shown that couples could be made of a suitable thickness to withstand the explosions without fusing, but thin enough to follow the changes of temperature with accuracy, except in the region of the explosion.

Values of PV/T were calculated for several points on an expansion curve, and were found to be high at the explosion, because the measured temperature was low. But they settled to consistent values at last by the middle of the working stroke. The steady value agreed well with that obtained from points on the compression stroke. The temperatures in the region of the explosion were then calculated from this constant and the measured pressures and volumes, in a similar manner to that used by Professors Callendar and Dalby. The temperature at the explosion varied from 1840° C. to 2250° C.; the latter value being obtained with a very rich mixture. There was no provision for timing; but the maximum pressures and temperatures were attained earlier as the strength of the mixture increased.

The cyclical variations of temperature in the exhaust-pipe were also investigated by means of fine platinum and platinum-iridium couples. The maximum temperature during exhaust was found to be between 500° and 550° C. in all cases. The authors gave curves to show the cyclical variations at each place under different conditions of running. The engine was also fitted with thermometer pockets which entered the centre of the thickness of the liner at four points along the barrel. The cyclical variations of temperature were damped-out at this depth in the metal; and mercury thermometers could be used there to determine the mean temperatures under various conditions of running. It was shown that the temperature was mainly governed by that of the jacket water at the outlet, and that the temperature drop along the barrel was very steep with rich explosive charges. The latter effect was due to the high temperature of the metal surrounding the explosion space.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Pension Schemes for Workmen.

SIR,—Your correspondence columns of the 9th inst. contained a letter from Mr. F. W. Cross, of Lea Bridge, with reference to pension schemes for workmen, which I have read with interest.

The main object of Mr. Cross's letter appears to be to contest the claim of Tottenham and Edmonton to be "the first gas company to start a pension scheme applicable to workmen as well as the staff." In support of his contention, Mr. Cross refers to a scheme adopted by the Brighton and Hove, North Middlesex, East Cowes, and Lea Bridge Companies in 1912, and brought into operation at the beginning of the current year, or prior to the Tottenham scheme.

Mr. Cross goes on to say "the honour of the application of such a scheme to the workmen of a gas company should be given to the Directors of the above-named Companies, and particularly so to Mr. A. M. Paddon (the Chairman of the four Companies), the originator of the scheme, and through whom it was initiated, nurtured, and brought into operation." Without claiming to be "first" in the field, or wishing to detract from the honour due to Tottenham or the other Companies mentioned, I think it only fair to point out that a defined scale of pensions for workmen had been considered and adopted by the Directors of the Brentford Company at an earlier date.

Pensions have been granted by this Company for a very long period, but upon no fixed basis; and early in 1911 it was thought desirable to place the matter upon a more satisfactory footing.

A scheme was devised, under which the workman would be able to calculate at any period the amount of pension due to him, in the event of total incapacity for employment—the basis of calculation being age and length of service, with a maximum pension equal to two-thirds of the average weekly wage during last three years of service. On the death (while in the service of the Company) of any weekly servant, a grant is made to his widow, children, or dependents, equal to one year's pension, calculated on the age and length of service of deceased workman. No contribution is paid by the workmen.

This scheme was brought into operation in the latter half of 1911—during the Chairmanship of the late Mr. Ulick J. Burke, who was also a Director of the Lea Bridge Company.

I am quite sure that both Mr. Topley and Mr. Cross were unaware of the existence of the Brentford scheme, when making their claim of priority, and will be the first to acknowledge an earlier example.

ALEX. A. JOHNSTON, Engineer and Manager,
Brentford Gas Company.

Brentford, Dec. 15, 1913.

Corrupt Trading.

SIR,—Many will have read with pleasure and profit Mr. Charles Carpenter's recent speech to the Southern Juniors—more especially the portion of it dealing with bribery of gas engineers by dishonest manufacturers.

The pronouncement, coming as it does at a singularly opportune time, will no doubt carry great weight, and will help to diminish this immoral form of trading. But is it not up to engineers to show their detestation of all forms of bribery by instituting prosecutions under the Corrupt Practices Act?

PROBITÉ.

Dec. 17, 1913.

Electrical Losses at Walsall.

A scheme for the provision of a new electricity generating station was brought up for consideration at a private meeting of the Walsall Town Council last week. It is understood that the scheme has been prepared by Mr. E. M. Lacy, the Consulting Engineer who was called in to advise the Town Council when the heavy loss incurred on the undertaking last year became known. Though no official details are yet available, it is stated that the cost of the new works is likely to be from £40,000 to £45,000. It has been for some time recognized that the provision of a new generating station was the only way in which the Corporation could escape from the dilemma in which they find themselves. In the special report submitted by Mr. Lack to the Town Council condemning the existing works, it was pointed out that not only were they started on wrong lines—the system adopted having since been generally put aside—but that the site chosen was not a suitable one. In view of the fact that the capital outlay on the undertaking up the end of last year was over £147,000, the position is, says a local paper, a serious one from a ratepayer's point of view, as it is generally understood that much of the existing plant is out of date, and in all probability will have to be discarded. The extent of the capital which will have to be written-off in consequence is at present only a matter of surmise; but in some quarters the view is taken that the total cost of the conversion of the works into an up-to-date concern will be something like £70,000. It is, however, claimed that the outlay would be justified by reason of the fact that the new plant would enable current to be generated much more cheaply, and that the present complaints as to excessive charges would be obviated. The site recommended for the new works is at the Birchills; but the question has been eventually deferred to a future meeting for consideration of alternative sites.

Morecambe Gas Managership.—At a meeting of the Morecambe Town Council on Monday last week, the resignation of Mr. Cecil Rhodes Armitage, as Gas Engineer and Manager, was accepted with regret, coupled with congratulations on his appointment as Gas Engineer and Manager to the Lancaster Corporation. It was decided to advertise for a Manager at a salary of £180 per annum, and to issue a sealed testimonial to the efficiency of Mr. Armitage's services.

REGISTER OF PATENTS.

Calorimeters.

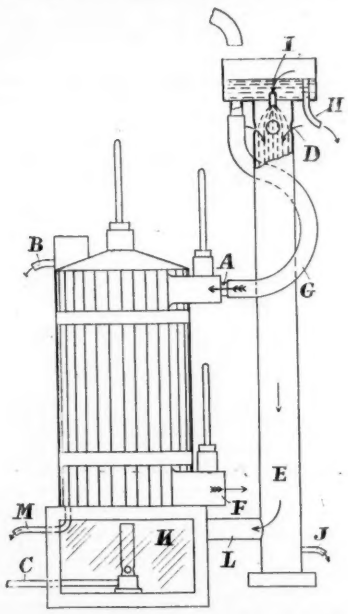
SIMMANCE, J. F., of Westminster Palace Gardens, S.W., and ABADY, J., of Fountain Court, Temple.

No. 27,920; May 30, 1912.

In the course of their specification, the patentees remark that in the class of gaseous and liquid fuel calorimeters in which the heat of the products of combustion is absorbed by flowing water, the air which passes through the calorimeter to support the combustion contains an amount of water vapour which varies with its temperature and the prevailing atmospheric conditions. It is further quite usual for the temperature of the atmosphere to differ from that of the water flowing through the calorimeter. The result is that the products of combustion issue from the calorimeter warmer or cooler than the atmosphere; and consequently, as the products are always saturated, they carry away a larger or smaller amount of moisture. Further, as a combustible gas will in most cases contain hydrogen, the condensing of the products of combustion will cause the deposit of a variable amount of moisture more or less as the percentage of hydrogen varies. As a large amount of air is required for combustion, and an excess is supplied, it follows that the products of combustion are largely mixed with such air, which, on coming in contact with the cold water surfaces, may add its quota of condensed water to the moisture attributable to the combustion of hydrogen. Naturally, both air and combustion products issue fully saturated; and thus the usual determinatian of "gross" calorific power by means of a calorimeter does not give, as it should, the true value of the "total heat" of the fuel.

The present invention relates to a calorimeter by means of which the total heat of the fuel is directly determined, of the type in which the gas-burner is placed in an enclosed chamber, and the gas and air to form the combustible mixture before passing into the calorimeter are fully saturated with water vapour and brought to the same temperature as the water which absorbs the heat from the calorimeter.

They provide a special inlet aperture into which air is brought by the action of a stream of water. To effect sufficiently long contact, and to entirely cool and saturate the air, it is most convenient to arrange a falling column of water in a large tube which draws in air at the upper end and passes it into the burner-box—the water itself falling into a sump-hole, whence it drains away. This falling column is conveniently utilized as the overflow from a constant-head cistern, which is elevated upon the tube through which the water falls.



Simmance and Abady's "Total Heat" Calorimeter.

An illustration is given of the general arrangement. Into the body of the calorimeter, water goes at A and comes out at B. C is the gas-supply pipe. The ingoing air enters by the holes D at the top of the large pipe E; while the cooled outcoming combustion products issue at F. At the top of the pipe E a tank is supported, from which water is led to the calorimeter by the tube G—a constant level being maintained by the overflow pipe H. [The constant-level tank is not a necessary part af the invention, but is a convenient method of making the water perform a double function—viz., to saturate and cool the air, and also to maintain a constant level on the inlet water supply and thus ensure a steady water flow through the calorimeter.] A stream of water issues from the opening I, and trickling downwards saturates the ingoing air. The excess water collects at the bottom of the pipe, and escapes through the overflow pipe J. The saturated ingoing air enters the burner-box K of the calorimeter through the pipe L. The water condensed from the combustion products passing through the calorimeter escape by the overflow pipe M.

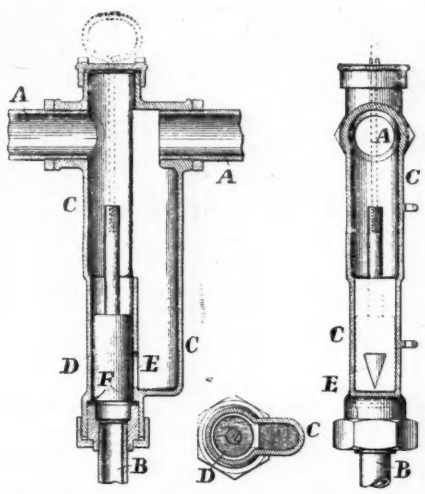
The gas is automatically condensed to the temperature of the ingoing air, by being connected to the gas-governor (of the wet type). The gas-pipe C may take the form of a tube of considerable length, lying coiled in the burner-box; the gas being thus brought to the temperature of the saturated air supplied to the box.

High-Pressure Gas Supply.

ALLDAYS AND ONIONS PNEUMATIC ENGINEERING CO., LIMITED, and NICHOLSON, A., of Birmingham.

No. 28,533; Dec. 11, 1912.

This invention relates to the supply of high-pressure gas for incandescent lighting by means of a booster between the main and the lamps.



Nicholson's (Alldays and Onions) High-Pressure Gas Apparatus.

A is the low-pressure main and B a pipe "loop" or bridge between the high-pressure main (not shown) and the low-pressure main, and having in it a gas-pressure controlling device C. At the end nearer the high-pressure main there is an internally cylindrical passage or port in which is fitted a plug valve D with a stem on which loading weights may be arranged. The passage is made up of the outer body of the control device and a division wall in which is a triangular opening E which, on the lifting of the plug, permits the high-pressure gas to escape into the low-pressure main. The apex of the triangular port being downwards permits a very fine passage to be obtained for the escape of gas through the control device from the high to the low-pressure main, and the further lift of the plug valve ensures a very gradual increase of the area of the opening E, and on the descending motion of the plug the opening is so gradually closed that the plug is "very efficiently balanced by the gas pressure, and so ensures a practically constant pressure in the high-pressure main."

To facilitate the removal of the plug valve when desired, the control device has a removable top or cover, and a wire handle is provided the screwed end of which takes into a hole in the stem of the plug as is indicated in dotted lines.

Manufacture of Coke.

MOELLER, J., and WOLTERECK, H. C., of Rochester Row, Westminster.

No. 28,791; Dec. 14, 1912.

In their specification, the patentees remark: "The present method of producing coke relates to the treatment of coal, coal dust, slack, and the like in suitable retorts which are heated from the outside, and where gas and other volatile products are driven off by the heat generated from the outside. We have found that coal, coal-dust, slack, lignite, and other mineralized carbonaceous material, when treated in the retorts with superheated steam at a temperature of 400° to 600° C., is coked very rapidly comparative to the present methods, and a larger amount of the volatile products is obtained. The temperature of the steam to be used and the duration of the process depends upon the quality of the coal or other material to be treated. It is equally dependent upon the heat of the steam employed and the coal used to obtain a coke of a softer or harder quality. The superheated steam is employed at a low pressure. By low pressure we understand a maximum pressure of 4 to 5 lbs., or merely sufficient to allow the steam to pass through the superheater and apparatus. We have found that, on account of the peculiar action of the steam in removing the hydrocarbons, the remaining coke has a great tendency to bake. Coke produced from coal dust or grit by this method can be conveniently obtained in pieces and blocks."

The only description of the process is this: "We carry our process into effect by placing the coal in pieces or in form of a coarse or fine powder into suitable retorts, containers, or coke-ovens, heated from the outside to the required degree of heat—about 600° C., and pass a current of steam superheated to about or preferably above the temperature of the charge through the mass until condensable vapours are no longer discharged. In case of the coal being in form of a fine powder, the same is advantageously moistened with 10 per cent. of water, in which case it may be rammed into the coking space, and will produce a coke of a superior quality."

They close their specification with these words: "We are aware that it has been proposed in the treatment of coal and other carbonaceous material for the production of gas and coke to employ as the heating agent within the retort steam produced in a low pressure boiler, and then highly superheated, and it was proposed in such process to operate with a boiler pressure from 10 to 35 lbs.;" and they claim: "The treatment of coal, coal dust, slack, and like mineralized carbonaceous

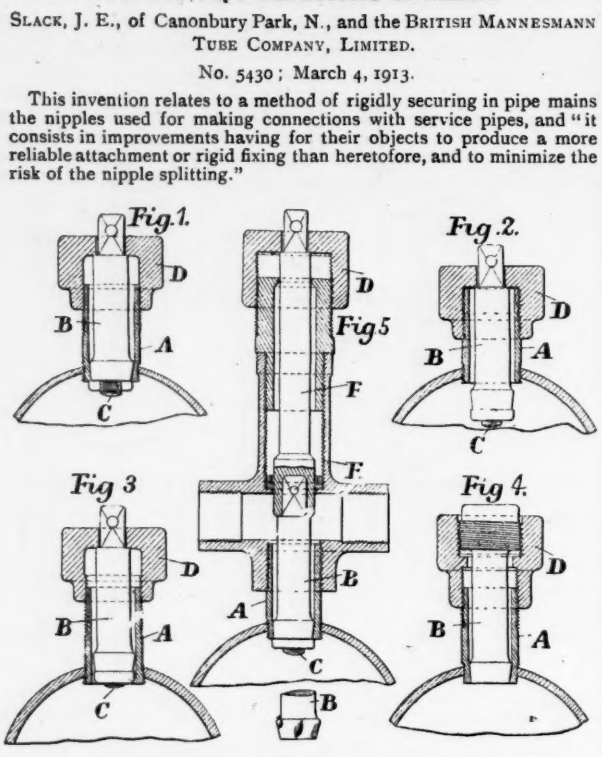
material for the production of coke and a larger yield of hydrocarbons by the introduction of highly superheated steam at low pressure into externally heated retorts containing the carbonaceous material."

Service Pipe Connectors to Mains.

SLACK, J. E., of Canonbury Park, N., and the BRITISH MANNESMANN TUBE COMPANY, LIMITED.

No. 5430; March 4, 1913.

This invention relates to a method of rigidly securing in pipe mains the nipples used for making connections with service pipes, and "it consists in improvements having for their objects to produce a more reliable attachment or rigid fixing than heretofore, and to minimize the risk of the nipple splitting."



Slack's (British Mannesmann Tube Company) Service Connections to Gas-Mains.

The invention is described by the patentees with reference to a sheet of illustrations in which fig. 1 is a section of a portion of a main showing a nipple screwed into it with the mandril in position prior to the expanding operation, and also the means for operating the mandril. Figs. 2 and 3 are sections of the same portion—the former showing the position of the mandril just as the expansion is completed, and the latter the mandril being withdrawn after an expanding operation. Fig. 4 shows a plain-ended nipple inserted in a drilled hole in the main, and means whereby the nipple end may be first tightened in its seat by drifting the mandril and the expansion subsequently completed by rotating the mandril. Fig. 5 shows means whereby the mandril may be operated when a branch piece is used in conjunction with, and is connected to, the nipple.

The lower end of the nipple A may be either plain or, if the hole be tapped, threaded externally; while the other end of it is threaded in the usual manner for the attachment, in the first place, of the mandril operating device, and subsequently of a service pipe. The internal tapered portion at the main end of the nipple is formed as a tube of an internal diameter corresponding to the smallest bore of the tapered portion. It is bored from the other end to the point where the taper is to commence, to a uniform diameter corresponding to the working bore of the nipple, and from this point to the main end to a bore that gradually decreases to the desired size. The mandril B has an end tapered to correspond to the taper in the nipple, and may be fluted so as not to be in full surface-contact with the tapered portion of the nipple. The upper end of the mandril is shouldered, and may be either smaller in size (the reduced portion being given a square or other flat-sided formation) or be increased in size (the enlarged portion being screw-threaded) for a purpose to be described. In figs. 1, 2, and 3, this upper end passes through a cap or nut D, which is made to engage with the threaded outer end of the nipple. The turning of the cap for the purpose of expanding the nipple rotates and pushes the mandril down; its lower end thus gradually forcing out the tapered portion of the nipple. The rotation of the mandril permits of the bearing portion of its tapered end acting upon the whole of the tapered surface of the nipple, thereby causing equal expansion upon its circumference. By the movement of the mandril the tapered portion of the nipple is thinned-out where it bears against the wall of the main, so that an increased thickness or extension results in the portion that projects beyond the inner surface of the wall of the main. The thickness of the tapered portion of the nipple is greatest at the inner or main end of the nipple where the expansion is greatest; "so that the resisting power in that portion of the wall of the nipple is substantially equivalent to that existing in the portion of the nipple which engages the wall of the main and is subject to the expanding force of the mandril."

Referring to fig. 4, the outer face of the lower end of the nipple is plain and fitting an unthreaded hole in the main. The nipple is provided with a shoulder, or with a collar, or is slightly tapered externally at its lower end, whereby the nipple is prevented from entering the main too far. The upper enlarged end of the mandril in this figure is provided with a screw thread—left-handed if that on the outer end of the nipple is right-handed, or *vice versa*. In this case the nut D is internally threaded at both ends for operating with the threads on the mandril and nipple. The nipple, with the mandril inserted in it and the nut D in suitable engagement with both, is placed in the hole drilled in the main. It is first tightened by rotating the nut to cause the mandril to descend until the shoulder of the mandril engages the shoulder of the nut, when the mandril, by reason of the abutting shoulders preventing further relative end-long movement of the two parts, will be rotated at the same time as it is forced downwards to expand the tapered end of the nipple.

Fig. 5 shows the manner of operating the mandril by a nut when the nipple is attached to a branch piece E and the head of the mandril is inaccessible for direct operation by the nut. In such a case a removable sleeve for attachment to the branch pipe and a spindle member F is employed. The sleeve is screwed into the piece E, while the spindle at one end is provided with a socket adapted to fit the reduced end portion of the mandril and be secured to it. The other end of the spindle has a flat-sided reduced portion which passes through the nut D in the same manner as the reduced end of the mandril in fig. 1. Thus, when the nut is rotated on the upper end of the sleeve, the mandril will be forced down and simultaneously rotated.

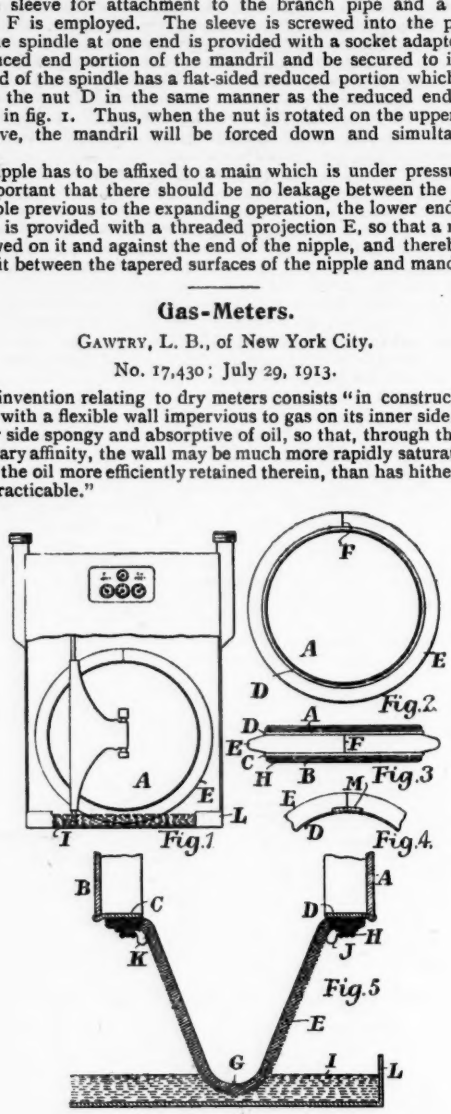
If a nipple has to be affixed to a main which is under pressure, and it is important that there should be no leakage between the mandril and nipple previous to the expanding operation, the lower end of the mandril is provided with a threaded projection E, so that a nut may be screwed on it and against the end of the nipple, and thereby cause a tight fit between the tapered surfaces of the nipple and mandril end.

Gas-Meters.

GAWTRY, L. B., of New York City.

No. 17,430; July 29, 1913.

This invention relating to dry meters consists "in constructing the bellows with a flexible wall impervious to gas on its inner side, but on its outer side spongy and absorptive of oil, so that, through the action of capillary affinity, the wall may be much more rapidly saturated with oil, and the oil more efficiently retained therein, than has hitherto been found practicable."



Gawtry's Dry-Meter Leather Diaphragm.

Fig. 1 is a front view of a dry meter, with the bellows shown in place. Fig. 2 is a front view, and fig. 3 an edge view of the bellows. Fig. 4 shows a portion of the bellows rim, and illustrates a bridge of spongy material disposed across the joint in the flexible wall of the bellows. Fig. 5 is an enlarged view, in section, of a portion of the flexible wall, supporting rings, diaphragms, and meter casing.

As ordinarily constructed, the patentee points out that the bellows or working chamber of a dry gas-meter comprises two metal diaphragms A B, secured in rings C D. The flexible peripheral wall E of the bellows has its ends secured together at F, and is attached at its edges to the diaphragms. Before the band is put in place it is usually stretched over an annular former, so as to give it an outward bulge or fold G. One of the diaphragms (as A) is free to move, so that when the gas under pressure enters the bellows and expands it, the band tends to flatten, and when the gas escapes it resumes its original shape. In order to make gas-tight joints, each edge of the band is secured to the rings by a wrapping of cord H.

As the chief objects sought by the makers have been imperviousness and flexibility, and as the grain side of the leather offers a smoother surface, and hence apparently one less likely to gather dust or impurities, it has hitherto been customary, the present patentee points out, to attach the band in place with the grain side outermost, and to apply the oil to this side. To saturate the band with oil in this way has always been a long process. It takes ordinarily from six weeks to two months to effect proper saturation, besides repeated applications of the oil, and the latter, in turn, requires personal attention and expenditure of time. In large installations where thousands of meters are in use, this delay and time loss are, he says, economically serious, in point of cost. To leave meters idle for the time necessary at present to saturate the leather is expensive; the care and attention incident to

the oiling are expensive; and as large numbers of sheep-skins per year are used for these leather bands, the aggregate losses due to the foregoing causes attain large figures, irrespective of those incident to the difficulties of re-oiling, or to the constant oversight required to prevent injury to the thin kid-like bands, should too long a time elapse after the degree of saturation has fallen below proper limits.

He claims to have discovered that all this trouble can be efficiently overcome by making the flexible wall of the bellows impervious to gas under pressure on its inner side, and spongy, and hence absorptive of oil, on its outer side. Then when the oil is applied to the spongy outer surface—even if the total thickness of the wall is very small—it will be drawn by capillary affinity into the outer spongy stratum, and rapidly spread through it, so that he has obtained even a better saturation of the band in thirty-six hours than hitherto in six weeks. The re-oiling can be made automatic by simply permitting the lower part of the band to dip in oil I, placed in the bottom of the meter casing L; the new oil then being drawn into the spongy outer layer of the skin to replace whatever amount may have evaporated.

He constructs the flexible wall in accordance with the foregoing description in various ways—as, for example, by employing a material spongy throughout and applying an inner impervious coating. But the simplest expedient is to attach the present sheep-skin band to the diaphragm rings, so that the flesh side shall be outermost. The spongy layer on the flesh side is said to be quite absorptive enough, when a good free-flowing lubricating oil is used, to become thoroughly saturated within the brief period before mentioned.

The saturation can be hastened by encircling the flexible wall with a strip of material more absorptive than the spongy layer itself—such as lamp wick—which will take up the oil rapidly and then deliver it to the band around its entire periphery. Two wicks may be used as at J K, and held at the edges of the band (say) by the already present wrapping cords. The wick in this case also bridges the joint at the ends of the band, so that the oil will cross over the joint by the wick from one end of the band to the other, and not be stopped by the joint which, if secured by cement, may act as a dam. If the encircling wicks are not desired, the joint can be bridged by a short section M of wick or spongy leather laid in contact with the band and held by the cord on one side, as in fig. 4.

APPLICATIONS FOR LETTERS PATENT.

28,220.—Rollason, A., "Production of ammonium chloride." Dec. 8.
28,245 —Carl Still (Firm of), "Direct recovery of ammonia." Dec. 8.
28,255.—M'Court, C D., and Kirke, P. St. G., "Heating materials in gaseous atmospheres." Dec. 8.
28,258.—Campbell, F. W., "Burners or mantles." Dec. 8.
28,285.—Robin, J. I., "Mantles." Dec. 8.
28,297 —Ley, S., "Gas-irons." Dec. 8.
28,326.—Davy, J. F., Mellor, P. H., and Lines, A. A., "Radiants for gas-fires." Dec. 9
28,330.—Gill, A., and Foster and Pullen, Ltd., "Inverted burners." Dec. 9.
28,389.—Berlin-Anhaltische Maschinenbau Akt.-Ges., "Purifying gas." Dec. 9.
28,402.—Stimson, E. F., "Safety devices for cocks." Dec. 9.
28,403.—Stimson, E. F., "Gas-heated hot-water circulators." Dec. 9.
28,446.—Cousin, P. A. J., "Gas producers." Dec. 9
28,455.—Hetherington, J., and Hutchinson, R., "Gas soldering stoves." Dec. 10.
28,499.—Plumstead, E., "Electric switch and gas-cock combined." Dec. 10.
28,501.—Pearce, C., and G. W. Pearce & Sons, Ltd., "Money-boxes for meters" Dec. 10.
28,515.—Clark, E. V., and Etchells, H., "Preventing leakage of gas." Dec. 10.
28,572.—Myhill, A. R., "Mantles." Dec. 11.
28,598.—Wye, F. H., "Acetylene generators." Dec. 11.
28,601.—Wainwright, W. H , "Measuring and recording apparatus." Dec. 11.
28,617.—Kogan, M , "Coupling for pipes." Dec. 11.
28,645.—Browett, T., "Combustible mixtures of air and gas." Dec. 11.
28,699.—Keith, J. & G., "Pressure-regulating or blow-off valves." Dec. 12.
28,716.—Deutsche Continental-Gas Ges., and Mucke, F., "Pneumatic distance ignition of gas-lamps." Dec. 12.
28,780.—Oxspring, R., "Lighting and extinguishing gas." Dec. 13.
28,819.—Still, W. M. and Sons, Ltd., and Still, E. H., "Valves for high-pressure gas tanks." Dec. 13.
28,820.—Tcherniac, J., "Extraction of hydrocyanic acid from coal gas." Dec. 13.

Electric Light Failure at Bury St. Edmunds.—The electric light failed for about an hour on Friday evening at Bury St. Edmunds; and the inconvenience inseparable from these occurrences resulted—to those shops, &c., which are solely dependent on electricity. There are, however, many shops in the town lighted by incandescent gas; and these, of course, provided a good object-lesson.

Electrical Breakdown at Eastbourne.—Saturday evening (and the Saturday preceding Christmas, too) was the unfortunate time at which the electrical supply in a large district of Eastbourne failed. The trouble arose through fusing of the cables; and about a couple of hours were occupied in putting things to rights. Meanwhile, shopping and postal work was carried on under disadvantages. A local paper says "it is not probable that the light will fail again this Christmastide." This may be said merely with the kindly desire to cheer up current users; or is it really evidence of a robust faith in the reliability of electricity which might be hard to justify?

PARLIAMENTARY INTELLIGENCE.

GASLIGHT AND COKE COMPANY AND CALORIFIC POWER.

Application for a British Thermal Unit Standard.

In the notices of intended applications to Parliament next session which appeared in the "Journal" for the 25th ult., it was mentioned that the Gaslight and Coke Company intended to ask for authority to substitute the British thermal unit standard for the one at present in use. We have now a print of the Bill which has been deposited, and can therefore indicate the nature of the Company's proposals.

In the preamble of the Bill it is set forth that it is expedient that the standard calorific power of the Company's gas should be expressed in terms of British thermal units gross per cubic foot, instead of in terms of calories net per cubic foot as provided by their Act of 1909; and that the standard calorific power prescribed by that Act and the other provisions relating thereto should be amended.

The clause to sanction the new standard is as follows:

> (*a*) The standard calorific power of the gas supplied by the Company in any part of their area of supply shall be 540 British thermal units; but the Company shall not incur any liability in the event of their supplying gas of a calorific power of not less than 475 British thermal units.
>
> (*b*) One testing only for calorific power shall be made at each testing-place daily; but in the event of the calorific power being on any testing ascertained to be below 475 British thermal units, the gas examiner shall forthwith give notice thereof to the Company, and a second testing shall be made at an interval of not less than one hour from the time of making the first testing at that testing-place; and the average of the two testings shall be deemed to be the calorific power of the gas at such testing-place on that day.

Section 42 of the Act of 1909, giving power to the Board of Trade to vary the standard calorific power, is to be read and construed accordingly. The apparatus to be prescribed by the Referees for testing the calorific power of the gas is to be the most suitable for ascertaining the total heat value of the gas.

The provisions as to testing for calorific power contained in sections 40 and 41 of the Act of 1909 are to be amended as follows: 28 B.Th.U. are to be substituted for 6 calories, and 475 B.Th.U. for 112½ calories. The scale of penalties in sub-section 2 of section 40 is to be amended so as to stand as follows: "Where the deficiency does not exceed 14 B.Th.U., £5; where it exceeds this, but does not amount to 28 B.Th.U., a sum not exceeding £10; and for each complete 28 B.Th.U. of defective power, not less than £25 and not more than £100. Section 41 (relating to the West Ham district (is to be amended so as to enact that for deficiencies as in the first two cases the penalties shall be as stated, but that in the third case the penalty is not to exceed £20 for each complete 28 B.Th.U. deficiency.

The Company will ask for an extension of the provisions as to calorific power to part of the area of supply in which they are not now applicable, and for relief from existing obligations in regard to the prescribed illuminating power of the gas. The provisions of the Company's various Acts are to be amended so as to be read and construed as if all reference to illuminating power and the testing thereof were omitted. Section 44 of the Act of 1909, relating to the charge for gas south of the Thames, is to be repealed, and one to the following effect substituted for it: Section 39 of the Scheme of Amalgamation with the London Gaslight Company, confirmed by Order in Council on May 22, 1883, is to be read and have effect as if the words "16-candle," "of the same illuminating power," and "of similar quality" were omitted from the second proviso to the section.

EXTENDED POWERS FOR THE LIVERPOOL GAS COMPANY.

As intimated in the notices of intended applications to Parliament next session which have already appeared in the "Journal," the Liverpool United Gas Company will seek sanction for extended powers, the nature of which will be gathered from the following epitome of the Bill which has been deposited.

First of all, it is proposed to omit the word "United" from the title, and extend the limits of supply so as to include the parish of Childwall, which is now within the city, the urban district of Little Crosby, and the parishes or townships of Aintree, Netherton, Sefton, Lunt, Ince Blundell, and Thornton, in the rural district of Sefton, in the county of Lancaster. The Company require authority to purchase from the Marquis of Salisbury the existing mains in Childwall. The share capital is to be converted; £2 of ordinary stock to be given for each £1 of the existing "A" stock, and £1 8s. of the first-named stock for every £1 of the "B" stock. Additional capital to the amount of £1,000,000, including premiums, is applied for, with borrowing powers to the extent of one-third of the capital raised at the time of borrowing; also powers to create debenture stock. Authority is required to issue ordinary stock for purposes of the co-partnership scheme. The profits of the Company to be divided in any half year are to be limited to 5 per cent. per annum on the ordinary stock, and to such rate, not exceeding that just named, on the preference stock, as shall be specified in the resolution creating the stock. The Company's Act of 1882 is to be amended so as to increase the amount of the reserve fund.

The Bill contains a number of provisions bearing upon the quality, testing, and pressure of gas. On and after the passing of the Bill, every enactment in force under which the Company are required to supply gas of a prescribed illuminating power is to cease to apply, and the Company are not to be under any liabilities in this respect. The gas to be supplied by them is to be "of a standard calorific value of 540 B.Th.U.;" but the Company are not to be liable to any penalty

or proceedings for or in respect of deficient calorific power, except in accordance with the provisions set out in the Bill. If the calorific power on any day is less than 475 B.Th.U., the Company are to be liable to the following penalties: Where the deficiency does not exceed 14 B.Th.U., £2; exceeding 14 and not amounting to 28 B.Th.U., up to £5; for every complete 28 B.Th.U., a sum not higher than £10. The Company are not to be liable for more than one penalty in respect of a deficiency in calorific value at both of their prescribed testing-places on the same day. They are to provide and maintain at each place apparatus for testing the calorific value of the gas—to consist of "a calorimeter to be agreed upon between the Company and the Liverpool Corporation or, failing agreement, to be approved by the Board of Trade, which shall be capable of being, and shall be, so used as to yield the total heat value of the gas in British thermal units." They wish to be relieved of liability for the presence in the gas of sulphur or sulphur compounds other than sulphuretted hydrogen. They undertake to supply gratis, within two years after the passing of the Bill, flat-flame burners suitable for the consumption of gas of the calorific value prescribed, in substitution for the burners (not incandescent) in use at the commencement of the Act. Notice to this effect will be given on each demand note of the Company during the period of two years already mentioned.

Other provisions of the Bill give power to the Directors to determine the remuneration of the Secretary, and to charge for any gas sold through a prepayment meter a not greater sum than that levied for gas supplied through any other kind of meter or by any other method. The charge for the hire of a prepayment meter and fittings is not to exceed 10d., and without fittings not to exceed 6d., per 1000 cubic feet of gas supplied, or 10 per cent. on the cost of the meter, whichever shall be the higher. Power is required to supply gas in bulk.

TESTING HIGH-PRESSURE GAS-METERS IN LONDON.

Proposals of the London County Council.

It has already been mentioned that the London County Council intend to apply to Parliament for authority to make provision for testing high-pressure gas-meters. The following is the portion of their "Various Powers" Bill they have deposited which bears upon this subject.

5.—(1) On and after April 1, 1915, no high-pressure meter shall be stamped by an inspector in the county except in accordance with the provisions of the Sale of Gas Acts as amended by this part of this Act, and no high-pressure meter shall be used in the county for buying and selling high-pressure gas, or for the collecting of any rates or duties or for making any charges on the passage, transmission, or conveyance of high-pressure gas, unless such meter is stamped by an inspector in accordance with the provisions as so amended of the said Acts or of the Act of 1859: Provided that the provisions of this part of this Act shall not come into operation in regard to any high-pressure meter in use in the county as aforesaid on the said date until the first day of April, 1916.

(2) On and after April 1, 1915, the Act of 1859 as regards high-pressure meters to be stamped or in use or intended for use in the county as aforesaid shall be read and have effect as if the provisions of this part of this Act (other than the section of this part of this Act of which the marginal note is "As to payments under this part of Act") had been inserted in the Act of 1859 instead of sections 12, 13, and 19 thereof.

High-Pressure Meters to Comply with Certain Rules.

6.—Every high-pressure meter shall comply with the following rules:

(1) The meter shall have permanently marked upon it in some conspicuous place the words "high-pressure meter," together with particulars of the pressure, or, in the case of a meter constructed to measure gas supplied at varying pressures, the minimum and maximum pressures at which it is constructed to be used, such particulars to be in terms either of the height in inches of a column of water or mercury or of pounds to the square inch.

(2) The meter shall have permanently affixed thereto a suitable gauge or similar device by means of which the pressure of the gas passing through the meter may be readily determined by the consumer.

(3) The meter shall be so designed and constructed as to ensure that when the supply of gas to such meter is turned on or off there shall be no undue strain upon the mechanism of the meter.

(4) In the case of any meter which is so constructed as to allow gas supplied through such meter to exert pressure on any glass used in connection with such meter, plate glass only shall be so used, and such glass shall be adequately protected by metal bars.

(5) The measuring capacity at one revolution or complete action of the meter, and also the quantity of gas per hour at standard pressure and standard temperature which it is intended to measure in cubic feet or multiples or decimal parts of a cubic foot, shall be denominated or marked on the index of the meter in legible letters or figures.

(6) The index of every meter shall be so fixed in the meter that such meter may be readily stamped by an inspector in such manner that the index cannot be interfered with or removed from the meter without defacing the stamp.

(7) That part of the meter containing the index and the gearing between the index and the measuring chambers shall be secured to the other parts of the meter so that the meter may be readily stamped by an inspector in such manner that the meter cannot be opened without defacing the stamps.

Rules for Testing for High-Pressure Meters.

7.—(1) No high-pressure meter shall be stamped by an inspector unless, after examining and testing the index thereof, he is satisfied as to the accuracy of such index.

(2) Every high-pressure meter for the purpose of being tested shall be fixed upon a horizontal base, and be tested by an inspector in accordance with the following rules:

Test for Soundness or Leakage.

(*a*) Gas shall be passed into the meter under a pressure equivalent to double the pressure or maximum pressure at which the meter is constructed to be used, and the outlet of the meter shall be closed; and if there is any leakage or defect in the meter whereby gas escapes, the meter shall be deemed to be unsound, and shall not be stamped.

(*b*) Gas shall be passed into the meter under a pressure equivalent to the pressure or maximum pressure at which the meter is constructed to be used, and shall be allowed to pass out of the meter at the following respective rates according to the quantity of gas per hour which the meter is intended to measure as marked thereon:—

Quantity of Gas per Hour which Meter is Intended to Measure.	Rate per Hour at which Gas is to be Allowed to Pass Out.
Not exceeding 120 cubic feet.	Not exceeding 1-20th part of the quantity per hour marked on the meter or 3 cubic feet, whichever is the less.
Exceeding 120 cubic feet, but not exceeding 1000 cubic feet.	Not exceeding 1-60th part of the quantity per hour marked on the meter or 8 cubic feet, whichever is the less.
Exceeding 1000 cubic feet, but not exceeding 2000 cubic feet.	Not exceeding 10 cubic feet.
Exceeding 2000 cubic feet.	Not exceeding 15 cubic feet.

Provided that in no case shall the rate at which gas is allowed to pass out of a meter as aforesaid be less than one-half of a cubic foot per hour. Any meter found not to work under such conditions shall not be stamped.

Test for Correct Measurement or Percentage of Error.

A sufficient quantity of gas or atmospheric air shall be passed through the meter at the pressure or the varying pressures at which the meter is constructed to be used, and in a quantity per hour equal to the quantity of gas per hour which the meter is intended to measure as marked thereon. Any water used in such testing and the air of the room in which such testing is made shall be as nearly as practicable of the same temperature as the gas or air passed through the meter. If the meter registers quantities varying from the true standard measure of gas more than 2 per cent. in favour of the seller or 3 per cent. in favour of the consumer, when corrected to standard pressure and standard temperature, it shall be deemed to be incorrect as to measurement, and shall not be stamped.

Clause 8 sets forth that all meters found to comply with the rules and to work properly are to be stamped, and in clause 9 are given the fees for testing and stamping.

The Corporation of London, in accordance with notice, have included in a Various Powers Bill clauses in similar terms to those given above.

GAS CONSOLIDATION SCHEME FOR WEST MIDDLESEX.

The Proposed Amalgamation of the Brentford, Staines and Egham, and Sunbury Gas Companies.

Reference has already been made in the "Journal" to the proposal of the Brentford Gas Company to apply to Parliament for sanction to an amalgamation scheme under which they will absorb the Staines and Sunbury Gas Companies. The following is an epitome of the provisions of the Bill which has been deposited; and it will be seen that they include an extension of the promoters' general powers.

The first clauses refer to the consolidation of the capital, the voting powers of the proprietors, and the qualifications of the Directors. Next come clauses dealing with the limitation of the profits. As from Dec. 31, 1914, the profits in respect of any half year are not to exceed 4 per cent. per annum on the "A" stock, 3½ per cent. per annum on the "B" stock, and 5 per cent. per annum on the preference stock. The standard price is to be 3s. 9d. per 1000 cubic feet, with reductions or increases of 1s. and 1s. 3d. per cent. in dividends for every rise or fall of 1d. in the standard price in any half year. Provision is made for the creation of a reserve and a special purposes fund, and for the application of excess profits. As from the date of the transfer, the Staines and Sunbury Companies are to form part of the Brentford Company's undertaking; but they are to remain incorporated for specific purposes until June 30, 1915. The Company will issue "A" and "B" consolidated stock, preference stock, and debentures for the original, ordinary, and preference shares and debentures of the Staines Company, and "B" stock and debentures for the ordinary shares and debentures of the Sunbury Company, in the proportions specified. The Company wish to be empowered to create ordinary and debenture stocks for the purposes of the transfer.

From the reading of the meter indices for the quarter ending Dec. 25, 1914, to Dec. 25, 1917, the price to be charged for gas in the Staines district is to be 3d. per 1000 cubic feet more than in the Brentford district. After the last-named date it is to be reduced 1d. per year till the difference is extinguished. In the Sunbury district the extra price is to be 1s. 2d. per 1000 cubic feet until Dec. 25, 1915, and after that date is to be reduced 2d. per 1000 cubic feet each year until the price is the same as that charged in the Brentford district. The limits of supply in the Staines district are to be extended so as to include the parish of Laleham, and a portion of the parish of Stanwell now served by the Uxbridge Gas Company, whose powers to supply gas within

the parish of Harlington and part of the parish of Stanwell are to be repealed.

The Company ask power to construct and maintain gas-works on certain lands described in a schedule, and also to apply for Provisional Orders to enable them to supply electric energy, or acquire the undertakings of parties who hold Orders for this purpose in regard to places partly or wholly within or adjoining the Company's limits of supply. The acquisition of these undertakings is to be subject to the approval of the Board of Trade.

Among the miscellaneous provisions of the Bill are the following: The Company may supply, at an agreed price, power gas, to which the existing provisions as to illuminating power, pressure, and purity are not to be applicable; but it must possess "a distinctive and readily perceptible smell," or the Company will be liable to a fine not exceeding £50. This gas is not to be sold for lighting purposes; and the Home Secretary may make regulations for its supply. The Company may purchase or take on lease dwelling-houses for persons in their employ, and may erect, fit up, and maintain houses, cottages, and buildings for such persons on lands in their possession. No penalty is to be incurred for insufficiency of pressure, defect of illuminating power, or excess of impurity in the Company's gas, in any case in respect of which it is proved that this was caused by circumstances beyond control. In addition to the powers the Directors may exercise under the Companies Clauses Acts, 1845 to 1889, they may from time to time determine the remuneration of the Secretary.

In schedules to the Bill are given statements of the share and loan capitals of the three Companies concerned, descriptions of the Staines and Sunbury districts, and definitions of the lands which the promoters may purchase by agreement, and on which they may erect and maintain gas-works.

LEGAL INTELLIGENCE.

AFFAIRS OF MR. ROGER WALLACE, K.C.

Bankruptcy through Unsuccessful Ventures.

On the 28th of August last a receiving order was made against the estate of Mr. Roger Wallace, K.C., of Camden Hill Gardens, Kensington; and last Tuesday the public examination was held before Mr. Registrar LINKLATER, by Mr. E. S. GREY, the Official Receiver. A statement of the debtor's affairs showed gross liabilities £91,987, and an estimated surplus of £1163 in assets.

The DEBTOR stated that in 1873 he started business in Mark Lane as a chemical merchant. Between 1876 and 1879 he was actively associated with the Gaslight and Coke Company in the erection of their residuals works. He was also their agent for the sale of certain products, including sulphate of ammonia. In 1879, when he was "holding the market" against a combination of foreign merchants, he bought or contracted to buy about £100,000 worth of chemical stock to keep prices up. Other persons who were interested with him did not keep to their bargains, and sold out as prices rose. Having found himself in financial difficulties in 1879 he handed over all his assets to trustees for the benefit of creditors. His liabilities then amounted to about £150,000. A mutual arrangement was effected with all the creditors—a great many being paid in full. After this arrangement he studied for the Bar, was called in 1882, and took silk in 1896. For many years before 1908 his earnings as a barrister amounted to £6000 or £7000 a year. He did not keep to his profession because he was always interested in new things. Sometimes he made and sometimes lost money. Chemical research had been his principal hobby. He also interested himself in electricity and the telephone, and had been connected with a great many limited companies. He lost £30,000 in the Gas Traction Company, Limited, through taking over about £40,000 of debentures; £10,000 in an iron ore company, and £4000 in a peat industries company, in both of which he subscribed for shares; and £20,000 in the British Aluminium Company, Limited. The business of the last-named Company was now paying well. His loss was incurred through putting his money into the concern too soon. He made a profit of £30,000 in the Westminster Electric Supply Corporation, Limited. As a Director of a large number of limited companies, his fees in one year had amounted to £5000. Since 1908 he had been engaged almost entirely in chemical experiments, and had registered a large number of patents which in his statement of affairs he had valued at £73,000. He had submitted a scheme for the payment of his liabilities in full by vesting all his assets in a trustee for realization. Asked why he allowed a receiving order to be made against him on the petition of a creditor for £300 if his patents were worth £70,000, he replied that there were other creditors pressing him, and he thought it better to let the receiving order go. He added that he was the originator of the present method of making sulphuric acid. He gave up his interest in the patent relating to it when he went to the Bar, and it had since been worth probably £2,000,000.

The examination was concluded.

AN ELECTRICITY GENERATING NUISANCE CASE.

Injunction against the Brixham Gas Company.

Last Wednesday, Mr. Justice Neville, in the Chancery Division, gave judgment in the case of *Edwards v. Brixham Gas Company*, the trial of which had extended over many days.

Plaintiff is the owner of property in fee simple at Brixham, in the county of Devon, and defendants prior to 1904 maintained gas-works and manufactured and supplied gas on land adjoining the plaintiff's premises in Gas Lane. Since 1904, the defendants had acquired other land for the purpose of extending their works. By the Brixham Gas and Electricity Act, 1906, the defendants were authorized to enlarge and extend their works for the supply of gas, and to supply electrical energy within certain limits; and they had erected engines and plant for the production of electrical energy, including a water cooling apparatus for the engines. It was alleged that the defendants had so used their works, engines, and plant as to cause a serious nuisance to the plaintiff and the other occupiers of his premises. In particular, the working of the engine and plant caused great noise and vibration, and substantially interfered with the use and enjoyment of the premises, and injured the health of the occupiers. The vibration, it was said, had also occasioned serious injury to the fabric of the plaintiff's premises; and an injunction was claimed for the purpose of restraining further nuisance and injury. The defendants denied that they had committed, or were committing, a nuisance, and said their engines and plant were of the best design and make, and had been used with all skill and care.

His Lordship granted the injunction as claimed, holding that there was evidence of an actionable nuisance. He, however, suspended the operation of the injunction for three months, to enable alterations to be made in the plant necessary for complying with the order. He also gave liberty to apply in case it should be found that three months' time was not sufficient to enable the alterations to be made. The defendants were ordered to pay the costs of the action.

A Gas-Governor Dispute.

On Monday of last week, at the Southwark County Court, before Judge Granger, Messrs. W. Tice and Co. (New Company), Limited, of Union Street, Borough, sued Mr. Edward Tilling, a publican, for £3 15s., for a patent gas-governor, which was guaranteed to effect a saving of from 15 to 25 per cent. in the consumption of gas. A representative of the Company stated that the arrangement was that the appliance should be fixed for six months. On behalf of the defendant, it was claimed that the governor was perfectly useless, and did not effect any saving at all. Witness said he had a pocketful of testimonials; and he was asked if he had also a pocketful of the County Court summonses he had issued in circumstances similar to these. An offer was then made, by the defence, that the governor should be tested by an independent person. The case was adjourned for this to be done; defendant undertaking, meanwhile, to pay the money into Court, together with the costs of the day.

Reduction of the St. Petersburg Water Company's Capital.—In the Chancery Division of the High Court of Justice last Tuesday, Mr. Justice Astbury had before him a petition for sanction to resolutions for the reduction of capital of the Company. Mr. H. S. Preston, who appeared for the petitioners, said the original capital was £200,000, divided into 10,000 shares of £20 each. The Municipality acquired the undertaking in 1892, upon the terms of paying an annuity to the Company. In 1895, £7 a share had been written-off the capital as not represented by available assets. Since then, in 1908, £2 a share had been returned to the shareholders, and £3 a share in 1911. It was now proposed to return a further £3 a share. It was a question of distribution only, and the Company had no outstanding debentures. The usual resolutions had been passed in favour of the scheme; and his Lordship gave his sanction to it.

Lighting of Belfast Workhouse.—At last Tuesday's meeting of the Belfast Board of Guardians, Colonel M'Cammond moved the adoption of a report of the Works Committee recommending that the Workhouse should be lighted by the Selas system at a cost of about £4000. Mr. Elliott suggested that the Guardians should have a report from their own Engineer. Mr. Adams pointed out that they were offered the whole installation at £4000, or the savings of four years on the present system; the outlay on gas and electric light being now £1200 a year. The report, in his opinion, should be dealt with by an expert. Mr. John Wilson said the Selas Company would save 74¼ per cent. of the present cost of lighting; and in four years this would mean £4648, which would be their remuneration for the installation. The scheme would not cost the Guardians one penny. Eventually it was decided that the matter should be referred to the Board's Engineer.

Death from Electric Shock Caused by a Bell-Wire.—The following story is taken from the "Engineer;" and an electrical contemporary says it should be a warning to the very amateur electrician: "An accident which caused the death of a well-known professional man happened recently in Milan. The gentleman was in his bath-room when a cry was heard, and his wife, entering, found him upright in the bath motionless, and with his hand clasped round the fall of the electric bell, which hung from the ceiling. Thinking he had fainted, she ran to him, but on touching him received a severe shock. She had, however, unconsciously, broken away her husband's grip on the bell-pull; and the servants, who had followed immediately to find the master of the house already dead, were not affected by the current, and concluded that the accident was due to apoplexy. The wife, however, insisted at the medical inquiry on the shock felt when first touching the body of her husband. In spite of some scepticism, electric experts were called in, and it was discovered that the winding of the wires was damaged in several places, and that an electric light wire had established a contact with the wire of the bell. The current for this latter, being at only 4 volts, is naturally innocuous. That, however, for the lighting, as supplied by the Edison Company to the particular part of Milan concerned, is an alternating current at 160 volts. This, though not sufficient to kill the lady, dressed as she was in boots and with her feet on the dry wooden floor, had been fatal to her husband, whose hand and body were wet, and who was standing in water up to his knees. Under these circumstances, a pressure of 100 volts, or perhaps even 50 volts, would have produced the same effect. In fact, it is not many months since a precisely similar accident occurred to a lady in Paris, and in that case the fatal pressure was 110 volts. Familiarity with the daily use of electricity has, unfortunately, bred contempt; and the wires in houses are often taken down and roughly nailed up again in some other place by footmen, coachmen, and others."

MISCELLANEOUS NEWS.

THE LEEDS MUNICIPAL EMPLOYEES' STRIKE.

The amount of assistance offered, and given, to the Leeds Corporation in their troubles consequent on the "2s. per week advance all round strike" from the first augured ill for the success of the endeavour on the part of the unionists to beat the city authorities to their knees. Public opinion is often an uncertain quantity; but in this instance the organizers of the strike have stroked the fur the wrong way with a vengeance. They have learnt that, in Leeds at any rate, 99 per cent. of the population refuse to be forced by the remaining 1 per cent. to do what does not seem well to them. The municipal services of the city constitute a very considerable portion of what may be regarded as the necessaries of life in a large town—gas, water, scavenging, electricity, and tramways. This fact, of course, the strikers regarded as their strength; but it was also their weakness. For the ratepayers and officials did for themselves what the workmen declined to do for them. Leeds has set a good example.

On Sunday week, at a meeting of the men, Mr. Walter Wood, the District Secretary of the Gas-Workers' Union, said the demand was that an end should be put to the strike during the ensuing 48 hours. Otherwise the coal supply would be cut off, both by rail and by canal. At the same gathering Mr. Will Thorne announced that he would be content with a "reasonable advance." These remarks were an indication that all was not well with the men, especially when considered along with the facts that the electricity supply had been maintained without a break, and that trams were still running. It is true that the gas supply was a weak point; but by the following day (Monday) it was realized that even in this department arrears were being rapidly overtaken. A constant succession of recruits presented themselves at the offices, and were promptly accepted and set to work. The case was the same with the tramways; but here the men presenting themselves were the regular employees, who had tired of the strike. The electricity works were equal to all demands for current; and even the streets in the centre of the city were swept—by mechanical sweepers worked by foremen and other loyal servants under ample police protection. By this time, the labour men were applying themselves to the ticklish question of "re-instatement;" and a dignified line of retreat was being earnestly sought. The shortness of the gas supply, of course, inflicted loss on a large number of workers in the different factories where it is used for light, heat, or power; and this did not tend to popularize the already generally condemned strike. During dinner hour on the Monday matters were enlivened outside the gas offices, where the strikers assembled to "demonstrate." Mounted police scattered them; the men retaliated; batons were drawn; and, so the report runs, "effective practice for a brief space quickly disposed of all resistance." The New Wortley Gas-Works, to which the volunteers were conveyed in motor-cars as soon as possible after being registered, were amply guarded by police. Many strikers gathered outside the gates; but they were unable to get a word with the occupants of the rapidly driven cars as they dashed into the yard. The watchers, as the day advanced, were afforded the doubtful pleasure of seeing the holder lifts steadily rise—which may have caused them to reflect that no man is indispensable.

Tuesday was marked by further evidences of collapse; these being most marked in connection with the Tramway Department. All day men from this branch of municipal service were hurrying back to work; and it is said that even the pickets stationed at the gates of the depôts joined in the *sauve qui peut*. The manufacture of gas was resumed at the Meadow Lane and York Street stations; and by evening the situation all round had greatly improved. At a mass meeting of strikers, a good many ill-considered things were said; but these no doubt were uttered chiefly under the smarting sense of defeat from which the leaders must have been suffering. In the afternoon the Chamber of Commerce held a meeting which, though it comprised men of all shades of political opinion, was unanimous in supporting the line taken by the authorities. On all sides the City Council were exhorted to stand firm. Among the volunteers at the gas-works, the University students were said to be making themselves particularly useful—nearly 200 of them working, with the others, shifts of twelve hours at a stretch, with two breaks of half-an-hour each for meals.

By Wednesday the streets of the city had returned to an almost normal appearance; and a steady improvement in all the public services was reported. A better day-service of tramcars was running, though an evening service was still thought inadvisable. There was an adequate supply of gas for lighting purposes; but the pressure was not quite normal. A larger number of street-lamps were lighted than had been the case since the strike began; and little difficulty on account of darkness was experienced in the suburbs. The amateur workers were becoming quite expert in the performance of their self-imposed tasks. Another point for consideration by the strikers was the fact that the Gas Department had had hundreds of applications from men who were prepared to accept regular jobs on the works. The absence of serious disturbance continued to be a feature of this ill-starred strike. Electricity consumers were afforded ample opportunity for appreciating the efforts on their behalf of the volunteers in this department; and the Cleansing Department carried out necessary work, under the protection of mounted police—the exceedingly thoughtful announcement being made that the department intended to continue any necessary cleansing "with as little annoyance to the strikers as possible." As for the water-works, the applications for jobs here were so numerous that every place could have been filled in five minutes. Several thousand persons engaged in different industries in the city were still idle owing to the strike.

A special meeting of the City Council (convened by the labour party) was held on Wednesday afternoon—the Lord Mayor (Mr. E. A. Brotherton) in the chair. The proceedings, however, were a great disappointment to those who had called the meeting. It seems that two resolutions were handed in—one in the name of Alderman Wilson and the other by a labour member. The terms of these were very similar, except that one included names and the other did not; but as Alderman Wilson's was handed in first, it was taken first by the meeting. In half-a-dozen words or so, it was put and carried; and the labour members (who had come fully prepared to put forward their case) had lost their opportunity—for the second resolution was superfluous, and therefore out of order. The labour party were angry; but this did not make up for the want of knowledge of procedure which had spoilt their chance. The resolution passed was: "That the Council delegate all matters arising out of, or in connection with, the strike to a Committee consisting of Aldermen C. H. Wilson, F. M. Lupton, R. A. Smithson, J. R. Ford, and F. Kinder, with full powers to act." The same evening the Committee met, and after a long sitting it was decided to give the men on strike up till 6.30 p.m. on Friday to apply for re-instatement.

The result of the ultimatum to the men became evident on Thursday, when, at a mass meeting, the tramway men decided by a practically unanimous vote to return to work. Some of those who offered themselves for duty during the day complained bitterly of the fact that they had been greatly misled by the extreme Socialist section of their colleagues. An evening service was not ventured upon, owing to the difficulty of arranging for adequate police protection. Cheering reports were received from the Gas Department, where, in spite of "Stand firm" resolutions, several of the men offered to return to work. A better pressure of gas was maintained; and the amateur stokers having proved so successful at New Wortley, arrangements were made to similarly staff the Meadow Lane and York Street works. It is said that at Meadow Lane on Thursday there were 140 students engaged in the various ramifications of the gas-making industry, besides large numbers of free labourers, who were brought up in sections of forty in a motor omnibus. At the electricity works all continued to go well; and here, also, there were several applications made for reinstatement.

A deputation appointed by the Leeds Trades Council visited the University, and laid before the Pro-Chancellor (Mr. A. G. Lupton) and the Vice-Chancellor (Mr. M. E. Sadler) their objections to the use of students' labour at the electricity and the gas works. Mr. Sadler replied that when, a week ago, requests for assistance reached them from certain departments of the city, a number of them—seniors and juniors—thought it their duty as citizens to give the help desired. The University had not acted officially in the matter; but those connected with it had simply done the same as many other private citizens—offered the help needed. Much more help would have been forthcoming from the University if the city had required it. If the same circumstances arose again, he, for one, would act again in a like way. Mr. Lupton spoke in the same strain, and added that no one—particularly those engaged in a public monopoly touching the essentials of life—should leave work except after the expiry of his legal notice. He suggested the provision of a permanent tribunal of appeal, whose moral authority should be strong enough to ensure its recommendations being accepted by all local governing bodies. Other outcomes of the strike on Thursday were the formation of a Citizens' League (having for its object the maintenance of the public services and the liberty of the inhabitants), and a cowardly attack on a student who was proceeding home after serving as a volunteer at the New Wortley Gas-Works. He and a companion were escorted almost to Holbeck Station by police; but directly the officers left them, they were set upon by a ruffian, who, wearing knuckle-dusters, so battered the unfortunate student's head that he was carried home unconscious with his skull fractured and his face terribly lacerated. The miscreant got away—only, it is to be hoped, for a time. For the most part, of course, the volunteers have been living on the gas-works day and night; but the victim of the outrage had preferred to return home in the morning after working all night.

During Friday, there was a steady run of applications from former employees in the different departments; and by 6.30—the time by which the Special Committee had said applications for re-instatement should be received—it was found that, out of 4993 men affected at the time of the strike, 2028 were either working or ready to start. Later figures showed an improvement even on this gratifying percentage. The skilled gas workers returned in sufficient numbers to ensure a speedy reorganization of the work with the aid of new hands from outside; those remaining on strike being for the most part in the unskilled grades. After ascertaining the state of affairs on the expiration of their time limit, the Special Committee met to consider the next step to be taken; and during their deliberations they were waited on by a deputation consisting of the Vicar of Leeds, the ex-Lord Mayor, and Mr. Charles Lupton. The deputation asked whether any difficulty stood in the way of a conference between the Committee and representatives of the workmen; and afterwards they sent a message to the Secretary of the Leeds Trades and Labour Council stating that the impression left on their minds as the result of the interview was that they had every reason to believe that if the men themselves asked for an interview it would be granted. This was confirmed by Alderman Wilson in a letter to Mr. Walter Wood. As further proof of their willingness to make an easy way out for the strikers, the Committee also decided to give preferential consideration to applications from former employees if made before 10 o'clock on Monday morning—after which time all applications would be considered entirely on their merits, and quite apart from previous service.

Acting on the assent given by the Special Committee, a large deputation representing all grades of the strikers met the Committee on Saturday; and, after a long discussion, the conference adjourned until yesterday afternoon. There was a heavy demand on the gas-works; and on Sunday arrangements were made to conserve the supply, in anticipation of the requirements during Christmas week. A mass meeting was held on Sunday; and at it the men were treated to big oratorical efforts. But no solid comfort could be given to them. A reward of £50 is offered for information which will lead to the apprehension and conviction of the person or persons who perpetrated the outrage on a young student at the Holbeck Railway Station. A volunteer workman was killed at the Meadow Lane Gas-Works on Saturday evening, while endeavouring to start an acetylene flare lamp. He was standing on the apparatus when (perhaps owing to ignition by a lighted match or cigarette) there was an explosion. The man was

shot upwards to the roof, and in descending his head came in contact with an iron girder. Death was practically instantaneous.

EXPERIENCES OF UNIVERSITY MEN.

Along with the citizens generally, the students in the Leeds University have, as our report shows, rallied well at the call of duty, and have given invaluable help to the authorities in maintaining the public services. In fact, practically all the men of the Department of Coal Gas and Fuel Industries have been busy at the gas-works (for which the consumers should be everlastingly grateful to them); and the following two brief accounts of experiences—written under easily understood difficulties—have been forwarded to us. The first is from a graduate (B.Sc. in Gas Engineering) of the University, who is now working with Professor J. W. Cobb for an honours degree.

"When I arrived, there was a big demand for clinkerers; and so I went straight on to that. The furnaces seemed to have been left untouched for days; from some we took as much as seven large barrows of clinker. After getting these comparatively clear, I was transferred to a retort-bench, which we started up. The drawing machines (West's compressed air) were manned by students from our department on both day and night shifts, and the chargers by engineering students. With a little practice, we soon obtained speed, and could do the 120 odd horizontal retorts during the day at least once, and about half of them twice. Practically our only breakdowns were due to not getting the rakes quite back, and so bending the rods on the mouthpieces. The rods were, however, very easily straightened or replaced. All the men (students and men from Corporation departments) on our shift worked well. Surprise was generally expressed at the ease with which one fell into any task, in spite of the lack of experienced men to guide one. Here, of course, our theoretical training stood us in good stead, as we had only to get accustomed to the actual details of working. Personally, I had not previously worked in a gas-works, but have had experience on a producer plant and in engineering works. The experience we are getting will be invaluable, as it would take months, or even more (in a regular time) to see and do what we are now doing. As for myself, I am enjoying the time; the only drawback being that we cannot get home when off duty."

"I have just finished 52 hours' work on a retort-bench; and I am jolly glad I came. It is a very fine experience. We hob-nob with all classes—from the navvy to the "nut," and all get on very well together. Of course, not being used to continuous physical work, we find it no light task, but are all doing our level-best, and, as we believe, with success. There has been a little grumbling at the food; but I must say that I have not heard a single complaint on this score from the many university students. We find the work rather trying; but it must be remembered that we are working twelve-hour shifts. I think that we could fall into the job very nicely in a fortnight or so, and might show the regular men a point or two. The jobs I have come across involve very little mental exertion on the part of the men. I feel compelled to repeat what I said at first—it has been magnificent experience for us all."

The fact may again be emphasized here—as stated by the Vice-Chancellor, in reply to the deputation who objected to the use of students' labour at the electricity and gas works—that the University has not acted officially in the matter at all. The students, along with individual citizens of varying ages and positions, have been actuated solely by a sense of public duty, and a full recognition of the urgency of the situation.

NON-UNIONIST QUESTION AT ARMLEY.

Labour unrest in Leeds has not been altogether confined to the men connected with the municipal services; for, on the 12th inst., the "Yorkshire Evening Post" announced that 600 men employed by Messrs. Wilsons and Mathiesons, at Armley, had decided to down-tools because a few of their fellow workmen would not join the union. This was a promise of a new experience for the firm, who (with the exception of a little trouble with a few labourers last summer) have never had a strike among their workmen during the past fifty years. The relations between the controlling head and the employees have always been most cordial. Unionists and non-unionists have worked side by side; and for twenty years the firm have adopted a neutral attitude—putting no obstacle in the way of men who wanted to join the union, and declining to compel any of their servants to become members. Some two months ago, however, the National Union of Stove, Grate, Fender, and General Light Metal Workers appeared on the scene; and most of the workmen were induced to "toe the line." A few of the old servants refused to do so; and it was to coerce them that the whole of the others—both at the Scotch foundry and at the Carlton Works—handed in notices. In reply, the firm intimated that if any of their employees refused to join a union they would not be dismissed for such refusal, and they would be protected to the best of the Company's power. In an interview, Mr. Mathieson pointed out that some of the men whose dismissal the union desired had been with the firm for over forty years. On Dec. 13 (the day when the notices expired), it was stated that the dispute had been settled as the result of negotiations, during which the few non-unionists in the works decided to join the union. "There is," says the newspaper, "reason to think that the non-unionists who objected to coercion had every pressure brought to bear upon them to give way. The firm declare that they are still perfectly neutral with regard to the non-union question, and that they still stand for freedom of contract as between themselves and their men."

The operations which are being carried out at Woodmancote (Sussex) with the view of finding a source of water are proceeding much more satisfactorily than was expected; and it is now anticipated that the selected site will furnish an ample public supply for Southbourne, Westbourne, and the district generally. Water was found at a depth of 43 feet, and from the borehole of 400 feet a flow of 75 gallons per minute was obtained during an extended test. The latter quantity is more than sufficient to satisfy the requirements of the Local Government Board.

BLACKBURN GAS-WORKERS' DEMANDS.

Bright Prospects of an Early Settlement.

There is every reason to hope for a speedy and peaceful settlement of the dispute which has arisen at Blackburn in connection with the rates of pay of a section of the gas workers and workmen employed in other departments of the municipal service.

The men had threatened to cease work simultaneously last Wednesday; but on Monday evening Mr. J. R. Clynes, M.P., the General Secretary of the Gas-Workers' and General Labourers' Union, addressed a crowded meeting of the men in the Burton Street Mission Room. Mr. Clynes said the cases were extremely rare in which a Union like theirs, representing so many thousand corporation employees throughout the country, took the extreme step of tendering notices. So far as the present officers were concerned, Blackburn was the only instance where they had had to have a strike of gas workers; and this was many years ago. They did not seek trouble if it could be avoided, and they did not tender notices merely as a menace to those who controlled the affairs of corporate bodies. They tried by long, and sometimes laborious, exertions on their part to arrange honourable and reasonable settlements as between corporations and workmen. Dealing with the Blackburn dispute, he said that in the middle of the summer they presented claims for the general body of Corporation workmen, and in February for the men at the gas-works. In the case of some of the workers, the claims had been settled; and, as regarded the gas workers, only the claims of the stokers and labourers were left unsettled. The case of the gas-workers' labourers was considered by a Sub-Committee, who decided to advance their wages from 6d. to 6½d.; but this decision had not been acted upon, because it was referred to some other Committee who were dealing with questions raised on behalf of all classes of labourers. It was not the gas workers themselves who insisted on making this a general question; but it was the procedure of the Corporation. The favourable decision in respect to the gas workers had been held in abeyance, and the men had suffered the loss of the advance that they should have received because of the particular method of procedure adopted. The Union officials had all along fully believed in the policy of patience, because they entertained the hope that this policy would pay and that in the result some reasonable offer would very soon be forthcoming. After the November elections, it was decided that the claims of the men could not be met; and it was then that the officials were compelled to concede the request of the members and tender a fortnight's notice for the gas workers. He had that afternoon received a message from the Town Clerk intimating his willingness that he (the speaker) should call upon him. Consequently, there had been a conference; but there was little he could put before them as the result. In effect, the Corporation suggested that the stokers should undertake to abide by the decision of some expert or arbitrator who would consider a report presented some time ago after a visit to one of the gas-works in Oldham; and he would, of course, also consider any rebutting evidence or facts they might have at their disposal with regard to this investigation. With regard to the gas-works and other labourers, the only message that he could put before them from the conference was that previously given out by Alderman Nuttall (Vice-Chairman of the Electricity Committee), who had declared willingness to consider certain cases of Corporation men who might be able to show that they had reasonable claims that their conditions and work were different from those of men in private employment. The Corporation took a stand that was to him totally indefensible, in that they refused to compare the Blackburn Corporation workers with the workers of other corporations. It was not fair for men who were employers themselves in private life to act in their public capacity as though they were considering the wages and conditions of their own private employees. Alderman Nuttall had urged that advances amounting to £1400 per year were granted during 1912; but none of this money went to the stokers or gas-works labourers.

Mr. Fleming Eccles, Assistant-Secretary to the Lancashire District of the Union, referred to the Sub Committee appointed to take certain tests at the local gas-works, to compare them with other towns. Blackburn and Oldham had been the selected towns. Previous to this, however, Mr. S. R. Ogden, the Engineer and Manager of the Blackburn Gas Department, had submitted a report as to the charges per ton of coal at the Addison Street Gas-Works. Mr. Ogden stated that it cost 2s. 2d per ton for stoking only; but if they included the total number of men employed in addition to stokers, and the general assistance which was required, the total cost was 2s 11d. Mr. Ogden also stated that the men carbonized only 72 tons of coal per day. These figures had been questioned; and it had been pointed out that the amount was about 84 tons per day. They were also told that if the town was compared with Oldham, they would be able to prove that the men at Blackburn worked under "drawing-room conditions" in comparison with Oldham. He (Mr. Eccles) knew Oldham well; and it was absolutely impossible for the work to be compared, because at no particular point was there any comparison which could be presented in a logical way. The figures showed that, whereas it cost 7d. per ton for stoking at Oldham, the cost at Blackburn, as stated by Mr. Ogden, was 1s. 9d.

The men afterwards discussed the situation in private; and at the close Mr. Clynes stated that, by a considerable majority, they had agreed to re-impower him to inform the Town Clerk of the men's willingness to hold their notices in abeyance for not longer than a fortnight, on condition that the respective Committees met immediately to decide the claims. The men, he said, were unwilling to put the town to the loss and inconvenience that would be involved in a stoppage of work during Christmas.

An Expert to be Called in.

A special meeting of the Gas Committee was held on Thursday night, when it was decided to call in an expert to advise and report on the points at issue before the expiration of the fortnight.

The Committee were addressed by Mr. F. Eccles, who was accompanied by two of the gas workers. He alluded to the comparison which had been made between the Blackburn and the Oldham works, and

urged that they could not compare the number of men employed in the two districts, as there was a material difference in the class of their work. Several questions were asked respecting the rates of pay of labourers at other gas-works. Mr. Eccles pointed out that most of the men had to leave the works in the summer time, and work as builders' labourers, for which they received 7d. per hour, in accordance with an agreement between the Union and the Builders' Association.

After the deputation had withdrawn, Alderman Nuttall moved that, as the figures concerning the Oldham and Blackburn Gas-Works were disputed, an expert should be called in, and that the Committee should abide by his report. This was approved. Alderman Nuttall also moved that the wages of the gas labourers be left to the Special Committee, consisting of the Mayor (Alderman Higginson, J.P.), the Town Clerk, and himself. This was also agreed to.

In accordance with the resolution passed by the Gas Committee for the appointment of an expert, the services of Mr. John Bond, Gas Engineer and Manager of the Southport Corporation, and Vice-President of the Institution of Gas Engineers, have been retained to report to the Committee upon the wages, work, and conditions of labour of the stokers at the Addison Street Gas-Works, and particularly as to how these compare with the corresponding factors at the gas-works of the Oldham Corporation. Our Manchester Correspondent says it is understood that Mr. Bond will visit Blackburn immediately, and that he hopes to complete his report by the 31st inst., when the men's notices expire.

Speaking at a mass meeting of the men earlier in the week, Mr. Fleming Eccles, one of the organizers of the Gas Workers' Union, declared that the Addison Street works are completely out of date so far as machinery is concerned.

MACCLESFIELD GAS SUPPLY.

A Curtailment and Resumption of Service.

On Tuesday and Wednesday of last week it was found impossible to maintain a full supply of gas to the town of Macclesfield; and, as a result, the public lamps were not lighted. Some of the mills and factories were affected, and shorter hours were worked. The inconvenience lasted until Friday; but our Manchester Correspondent, writing at the week-end, stated that, generally speaking, gas has been available the whole time, but at a reduced pressure. It appears that a Glover-West vertical retort installation has been in course of construction during the summer months on the site previously occupied by horizontal retorts which were in operation last winter, and the erection of the new retorts could not, as a consequence, be commenced until the end of the winter season. Though the work of erection and completion has been pushed forward with all possible despatch under difficult circumstances, and a portion of the plant put into operation a few weeks ago, it has been found impossible to complete the rest of the retorts in time to cope fully with the rapid increase in the daily consumption of gas at this period of the year. On Thursday the difficulty was partially overcome, and a full supply was available for a longer period. The full service was resumed next day.

POWER GAS CORPORATION, LIMITED.

The Thirteenth Ordinary General Meeting of this Company was held at the Westminster Palace Hotel, S.W., last Wednesday—the Right Hon. Sir ALFRED MOND, Bart., M.P., in the chair.

The GENERAL MANAGER AND SECRETARY (Mr. Wilfrid Beswick) having read the notice convening the meeting and the Auditors' report,

The CHAIRMAN moved the adoption of the report and accounts [see *ante*, p. 899], and the payment of the dividend proposed. In the course of his remarks he stated that a large number of important contracts had been secured for the installation of Mond gas plants, and also a number for the extension of existing installations. This, he thought, was one of the most satisfactory features of their business—viz., the number of large and important customers who, as they enlarged their trade, gave orders for extensions of their plants. They had also obtained some important contracts from various parts of the world—as far away as Manchuria and Central Russia. Throughout the year they had been extremely busy at the works at Stockton-on-Tees; and he might say the turnover for last year was the largest in the history of the Corporation. In order to deal with the increased business, the Directors decided to add an additional constructional shop, which was now erected and being used, and from which, of course, the proprietors would have the benefit in the current financial year. The total profit carried forward from the profit and loss account was £16,000, which, together with the balance of £3000 brought forward, made £19,000. The Directors proposed to apply this by increasing the reserve fund by £3120, by paying a dividend of 5 per cent. per annum upon the ordinary shares, less income-tax, which would absorb £12,481, and to carry forward the sum of £3549. The proprietors would see, therefore, that the Directors were distributing £12,000, and keeping a little more than £6000 in the business, besides the £3500 which they had written-off investments. He thought, generally, they might congratulate themselves on the position the Corporation had attained as the result of a good deal of hard work on the part of a very energetic and zealous staff during past years. There was no doubt the question of gas plants and gas firing was making headway, both in England and all over the world, in many new directions.

The VICE-CHAIRMAN (Mr. John Brock) seconded the motion, and it was carried unanimously.

The retiring Directors and Auditors were re-elected, and the proceedings closed.

PUBLIC OPINION, weighed down by a dead load of Prejudice against Gas Heating, is hard to move. But the PULL of our Hygienic Campaign plus the PUSH of your Co-operation must command SUCCESS.

The Davis Gas Stove Co., Ltd., 59, Queen Victoria St., London, E.C.

LIVERPOOL AND THE FAZAKERLEY GAS SUPPLY.

The Fazakerley Improvement Association, at a recent meeting, unanimously adopted a resolution emphatically protesting against the charge of 2s. 6d. per 1000 cubic feet of gas supplied from the Fazakerley Gas-Works belonging to the Corporation, compared with 2s. 1d. charged by the Liverpool United Gaslight Company to ordinary consumers, and 3s. 4d. per 1000 cubic feet against 2s. 8d. to slot-meter consumers respectively. The resolution further called upon the Corporation to charge prices for gas in Fazakerley corresponding with those charged by the Gas Company to all other districts in the city, and invited the City Council to appoint a Special Committee to inquire into the manufacture of gas at the Corporation works, to ascertain on how many occasions recently the supply has failed, and to make particular inquiry regarding the quality and pressure in comparison with that of the Gas Company, who formerly supplied gas in Fazakerley entirely to the satisfaction of the consumers.

Copies of the resolution were ordered to be sent to the Lord Mayor and the members of the City Council; and the matter has been considered at a meeting of the Committee having charge of the Fazakerley gas undertaking, and a reply forwarded to the Association. The Town Clerk states that the Committee are unable to see their way to accede to the request contained in the resolution, and explains that the Fazakerley gas undertaking was established because the district of Fazakerley was situated outside the area of the supply of the Liverpool Gas Company, and the Company had therefore no power, and were not desirous of seeking power, to supply gas in the district. With regard to the quality and pressure of the gas supplied, the Committee are satisfied that, as the result of special precautions, which are now in operation, they are being kept up to the standard of the Liverpool Gas Company; and as to the cost of the supply, the Committee consider that it is too early to expect the undertaking, which was established after two inquiries by an impartial officer of the Local Government Board, to be carried on so as to enable gas to be supplied at the same cost as the Liverpool undertaking. But the returns show that steady progress is being made in this direction; and the Committee hope that, as the undertaking develops, the price may be reduced and brought into line with that charged by the Liverpool Company.

Bitter complaint of the supply was made by Mr. A. G. Bernard, of Fazakerley, in a letter to the "Liverpool Post." The writer says the position is that the Corporation produce at a heavy loss a commodity which the community do not want, but which the community is compelled to use, and to pay 20 per cent. more for it than their neighbours. The consumers would prefer to use the gas of the Liverpool Company, and the Liverpool Company are willing to supply them. As a matter of business, the Corporation should give up an enterprise which involves them in serious annual loss, and the more readily so since all the parties concerned would benefit by the decision to do so. In support of his contention that the supply "is a disgrace to the city," he cites several cases of unsatisfactory service—the pressure having been reduced to such an extent that flames went out, and then having been increased again there was extensive escape through open taps.

BRIDGE OF ALLAN GAS ARBITRATION.

The arbitration between the Town Council and the Bridge of Allan Gas Company, as to the price to be paid for the undertaking of the latter, commenced on Saturday in the Caledonian Hotel, Edinburgh.

The Arbiters are Mr. Alex. Yuill, Gas Manager, Dundee, and Mr. R. Cockburn Miller, C.A., Edinburgh, with Sheriff Wilson, K.C., as Oversman. The Counsel engaged for the Company are Mr. F. T. Cooper, K.C., and Mr. J. B. Paton; and Mr. Avon Clyde, K.C., for the Town Council.

The sum originally asked by the Company was £37,600; but this was afterwards raised to £45,000. Discussion took place between Counsel as to the power of the Company to raise the price; but the matter was then left over for inclusion in Counsels' speeches at the close.

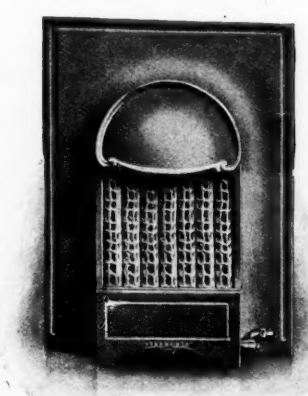
The first witness was Mr. Jenkins, the Secretary of the Company, who described in general terms its history and doings for over thirty years, during which he has been Secretary. He referred to it as a consumers' Company, as the Directors had refused to allow transfers to non-consumers.

Mr. Pullar, the Chairman of the Company, then gave evidence on much the same lines; but referred to the preferential treatment in regard to prices always given to the Town Council. He described how the Directors had made up the original price of £37,600, as upon the basis of £8 per share *plus* £600 for winding up, &c. As some of the shares had sold at £7 5s. 6d. each, he thought this was a fair price; but when they had engaged experts to advise them, they showed that the price should have been higher—namely, £45,000, and they had then amended the figure. In cross-examination, Mr. Pullar was pressed to agree that the Company had engaged and consulted experts before making-up the first price; but he was strong that no such consultation had taken place.

The whole of the afternoon was taken up in the examination of Mr. J. Stuart Gowans, C.A., who has examined, checked, and reconstructed the accounts on the lines required for statutory companies under the Act. The statements put in by him were numbered "A" to "R;" and in each case it was necessary to explain certain items and to show how they had been ascertained. Most of these statements had been agreed upon by the accountant acting for the Town Council (Mr. Nelson, of Glasgow) so that there was not much contentious matter.

The cross-examination by Mr. Clyde had commenced just before the close, and was directed to the proportion of the Manager's salary allocated to repairs and maintenance.

Long v. Short Radiants.



The fuel in our "D.S.O." fire extends from the burner to the canopy. This type of fuel has a larger effective radiating area and gives a greater efficiency than the shorter type.

The fact that it is necessary to place extra pieces of fuel across the tops of the upright short fuel is an admission that the latter by itself does not give the maximum efficiency.

These extra pieces of fuel add to the maintenance cost.

The "D.S.O." fuel, besides being the most efficient, is therefore also the most economical.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; 8, Exchange Place, Donegall Street, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

LEEDS UNIVERSITY LECTURES.

Department of Coal Gas and Fuel Industries with Metallurgy.

In connection with the work of the Department of Coal Gas, Fuel, and Metallurgical Industries at the Leeds University, arrangements have been made for the delivery, during the second term of the session 1913-1914, of the following special courses of lectures open to all persons engaged in any branch of the industries named, including power production. It will be noted that the lectures are all to be given in the evenings, instead of evenings and mornings as before; and they include a course on a subject of increasingly recognized importance—refractory materials. The opening of the laboratories for evening work on one day per week of the second term is more or less experimental; but it is a step which should be appreciated.

I.—THE CHEMISTRY OF COAL AND THE MANUFACTURE OF COAL GAS.

A course of twenty lectures, to be given on Wednesdays, at 6 p.m. and 8 p.m., during ten consecutive weeks commencing Wednesday, Jan. 14, 1914, divided into two parts, as follows:—

Jan. 14.—Part I.—Four Lectures on "The Chemistry of Coal and its Carbonization," by Professor John W. Cobb, B.Sc., F.I.C.

Coal—its origin and composition. Classification and valuation of coals in respect of their principal economic uses—*e.g.*, for steam raising, gas making, furnace firing, manufacture of coke, &c. Recent investigation on the nature of the constituents of coal and the mode of occurrence of nitrogen and sulphur in coal. The influence of temperature on the carbonization of coal, with special reference to the character and yields of gas, tar, ammonia, and coke.

Jan. 28.—Part II.—Sixteen Lectures on "The Manufacture of Coal Gas," by Mr. Harold G. Colman, Ph.D., D.Sc., of London.

A general description of the plant and processes involved in the manufacture of coal gas and carburetted water gas. Horizontal, inclined, and vertical retorts. Construction of retort settings. Methods of maintaining uniform temperatures throughout the retorts, with simultaneous economy in fuel consumption. The initial treatment of volatile products evolved from the retorts. Hydraulic and dry mains. Condensation. Elimination of tar-fog and naphthalene. Exhausters. Wet and dry purification. Cyanide recovery. Other bye-products—*e.g.*, coke, tar, ammoniacal liquor, &c. Manufacture of ammonium sulphate. Spent oxide. Spent lime, &c. The manufacture and carburetting of water gas. The analytical control of gas manufacturing processes. Discussion of present-day requirements for a public gas supply.

FEE.—For the whole course, £1 1s.; for Part I. only, 7s. 6d.

II.—REFRACTORY MATERIALS.

A Course of Eight Lectures by Professor John W. Cobb, B.Sc., F.I.C., on Tuesdays, at 6 p.m., commencing on Jan. 20.

Physical and chemical introduction. The properties and composition of the raw materials. The principles and methods of manufacture and testing. Silica, ganister, alumina, bauxite, kaolin, fire-clays, magnesia, chromite, graphite, dolomite. Grinding, grading, moulding, pressing, drying and burning, shrinkage, expansion and contraction, refractoriness. High-temperature furnaces and testing. Choice and use of refractory materials for gas retorts and settings, coke-ovens, steel and metallurgical furnaces.

FEE, 10s. 6d.

III.—EVENING LABORATORY COURSE.

The laboratory will be open on Wednesday evenings from 6 p.m. to 9 p.m., on the dates of Lectures I.—*i.e.*, from Jan. 14 to March 18 inclusive—for a limited number of students who have already received some chemical training, but desire some knowledge of gas-works testing or of laboratory work in fuel and metallurgy. The earliest possible application is requested from intending students.

Professor COBB, Mr. HODSMAN, Mr. W. CRANFIELD (for Gas-Works Testing).

FEE, 10s. 6d.; and a deposit (returnable) of 10s. to cover breakages.

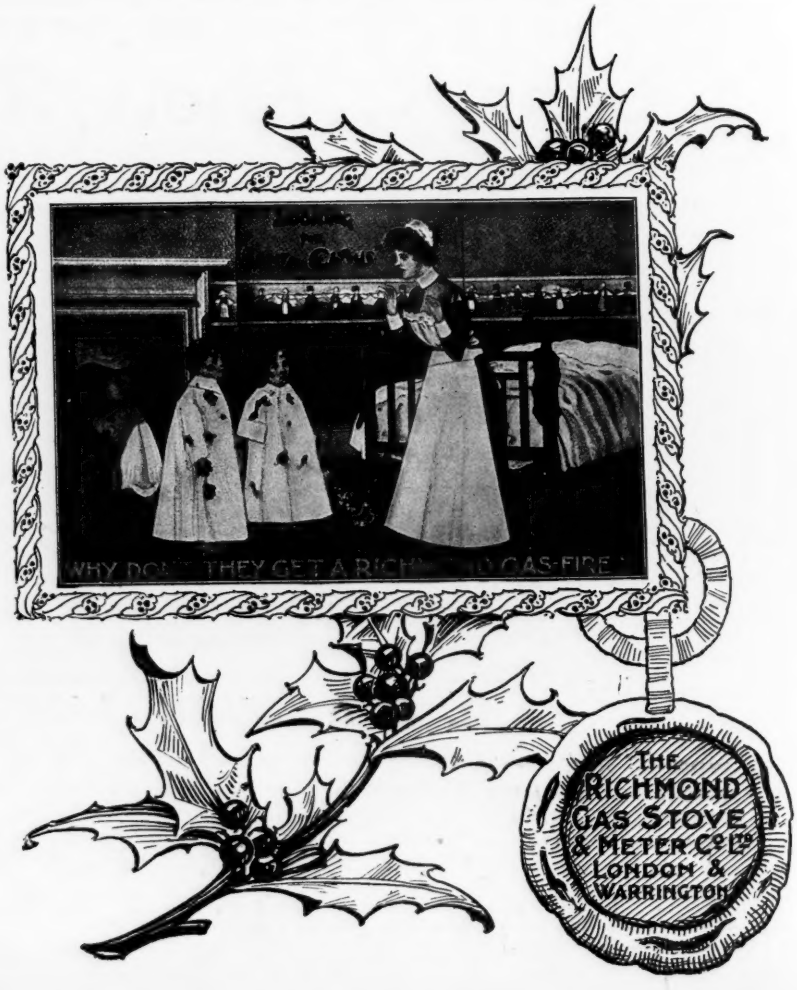
For students living at a distance from Leeds, overnight accommodation for a limited number can be provided at Lyddon Hall, the Hall of Residence of the University, at an inclusive charge of 6s. for dinner, bed, and breakfast. Early application for this accommodation should be made to the Warden, Lyddon Hall, Leeds. Students are, however, at liberty to make other arrangements; and, if desired, the University authorities will be glad to supply a list of registered lodgings.

Intending students for the special Courses I., II., or III. are requested to send in their names without delay to the Secretary of the University, specifying at the same time the course or courses which they desire to attend. The fees for the respective courses are payable in advance on the date of the first lecture. Other inquiries regarding the courses should be addressed to Professor John W. Cobb, B.Sc., F.I.C., the head of the Department.

The Gas Committee of the Batley Corporation have given instructions for the preparation of an estimate of the cost of the installation of a high-pressure gas system for the lighting of the principal streets, which are at present lighted by electricity.

Greetings

WE again offer you Season's Greetings and also thanks for generous assistance in making our business for 1913 another record.



THE Richmond GAS STOVE & METER CO LTD

WARRINGTON AND LONDON.

GAS POISONING TRAGEDY IN BELFAST.

A very sad gas poisoning tragedy occurred in Belfast last Thursday, when William Galbraith, aged 45, a cardriver, was found dead in his house, while six others—William Galbraith (20), Minnie Galbraith (16), Lilly Galbraith (12), Annie Galbraith (10), and Thomas Galbraith (3), all children of the deceased man—and Minnie Logan (16) and Nellie Logan (10), two nieces, were so overcome as to necessitate hospital treatment. Deceased was a widower. The theory as to how the affair occurred was that there had been an escape from the main during street repairs, and that during the night the gas made its way into the house under the chink of the hall door. Deceased was the first to come down stairs on Thursday morning. His son William, hearing a call, followed, and found the father lying on the floor. He placed him on a sofa and returned to bed. He evidently fell asleep or was overcome by the gas. At all events, it was evening when he became conscious that something was wrong, and going down stairs he was able to procure assistance. There was a prepayment gas-meter in the house; but the supply had been exhausted before the family had retired on Wednesday night. An inquiry into the matter was held on Saturday by Dr. JAMES GRAHAM, the City Coroner.

William Galbraith, son of deceased, said that when he returned home at 11.30 p.m. on Wednesday night the father and the rest of the family were in bed. He detected a smell in the coal-hole. There was one gas bracket in the kitchen, but the supply was exhausted. At six o'clock in the morning his father rose, but when he reached the kitchen he fell. On hearing his father call, witness went down and found him lying on his back and frothing at the mouth. With the help of a sister, he had him placed on a sofa. After that he could not tell what happened. He just "sprawled" up to bed and lay there until six o'clock in the evening. When he awoke he tried to dress himself, but could not do so, as he was so weak. Going down stairs, he noticed that his father was quite still. He called for his sister, and sent for help, and subsequently for the doctor, who pronounced his father to be dead. He did not perceive a smell of gas when he went down to the kitchen in the morning.

Maggie Galbraith said she detected a peculiar smell in the kitchen on Wednesday night, and thinking it came from some oily waste that was in the coal-hole, she took the waste and threw it into the road. During the night she felt ill. She saw her father on the sofa, but could not remember how she got back to bed. She was roused by her brother at six o'clock in the evening, and was then so ill that she could hardly walk down stairs. She had no recollection of opening the front door in the afternoon; but she saw her brother pull up a window blind and light the gas at 5.30.

Mr. SPILLER, solicitor, who appeared for the Corporation, said it was very strange, if the place was charged with escaping gas, that there was not an explosion when the gas was lighted.

Mr. *W. J. Hewitt*, a furniture dealer, whose premises extend to the rear of Linfield Street, said there was a strong smell of gas on Thursday morning, and he had a plumber brought in to test his own place. The plumber told him the escape must be from the main. He telephoned to the Gas Department on the matter at half-past nine in the morning, but the men did not come until half-past three. During the forenoon he had to send one of his workers into the fresh air, and he had a headache himself.

Claud Handford, who received Mr. Hewitt's complaint at the Gas Office, said it was not entered in a book.

E. P. Crooks said the complaint was taken as coming from Stewart Bros, Sandy Row, and an inspector was sent there, but was told that no complaint had been made; and he ascertained that there was no gas escape at Stewart's foundry, Maple Street, Sandy Row. On looking at a directory, he noticed the name "Hewitt Brothers," and Mr. Hewitt, on being communicated with by telephone, said it was he who had made the complaint. A man was at once dispatched to the place. As a rule, complaints were entered in a book when received by telephone. The workman left for this job at 10.10 a.m.; but he had other jobs to do as well.

James Gilliland, an Inspector in the Gas Department, deposed to visiting Stewart Brothers' establishment and Stewart's foundry and finding that in neither case had there been a complaint.

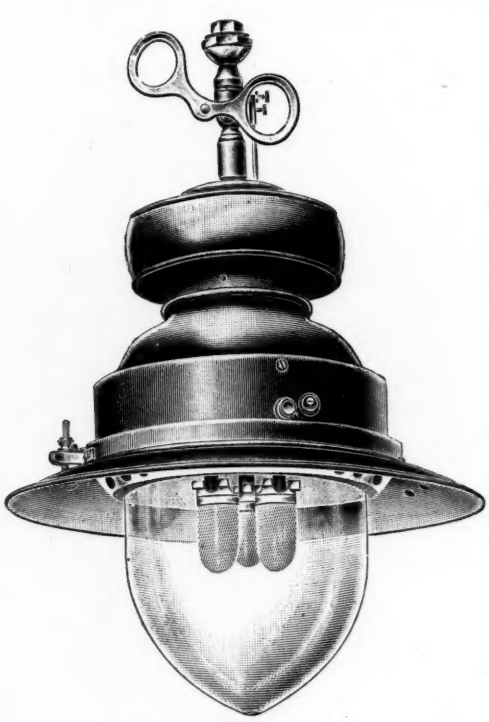
James Campbell, a gas inspector, said it was three o'clock when he heard of Mr. Hewitt's complaint. He went at once, and detected an escape of gas. He telephoned for a squad of men, who were on the spot without delay.

John M'Kee, a plumber, stated that the escape was traced to the street at a point nearly opposite Mr. Hewitt's gateway. The main was defective, and the escape was some 16 feet from the door of the Galbraiths' house. The pipe—a 3-inch one—was broken.

Mr. *A. M'I. Cleland*, the Distribution Superintendent to the Corporation, in response to a request to explain how escapes were discovered, said they depended on the public looking after their own interests and those of the Gas Department, and reporting immediately any escape. The public and the police were the chief safeguards. The broken main that had been referred to was temporarily repaired on Thursday. Next morning he had the ground opened and the place examined. He found that the broken main was over an old piece of wall. Evidently the pipe had been pressing on the wall, and through undue pressure it snapped and so allowed the gas to escape. The opening between the two pipes would not be wider than would allow a sixpence to enter. It was a perfectly new break, and must have occurred within 24 hours of the time when it was discovered. The main was laid in 1870—43 years ago. The gas might have entered the Galbraiths' house and Mr. Hewitt's premises through several channels. It might have penetrated the ground along the course of a water-pipe, or it might have passed along an old service-pipe that was cut off from the main some years ago.

Mr. JAMES REID, who appeared for the next of kin, commenting on

MAINTENANCE PROBLEM SOLVED.



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"BLANLITE"

No. 15 High Power Low Pressure Outdoor Lamp.

BRITISH MADE.

Rainproof. Shadowless. Windproof.

Number of Lights	1	2	3	4	
Candle Power	200	400	600	800	
Complete, Enamelled Steel	52/-	60/-	70/-	80/-	each.
,, Polished Copper	62/-	80/-	90/-	100/-	,,
Extra Globes (plain)	3/6	4/-	4/-	4/-	,,
,, Mantles	9/-	9/-	9/-	9/-	doz.
Parabolic Reflectors, extra	9/6	12/-	12/-	12/-	each

Cup and Ball Joint Extra. **Flashing Bye-Pass**

THE BLAND LIGHT SYNDICATE, LTD., 63, QUEEN VICTORIA ST., LONDON, E.C. (Four Doors from Mansion House Station). 2, CARR ST., Blackfriars & Deansgate, MANCHESTER.

the evidence, asserted that the Corporation officials had been negligent in connection with the matter.

Mr. SPILLER submitted that the officials could not have done more than they did, and said the interests of the children would receive sympathetic consideration from the Corporation.

The CORONER said he was sure the Corporation would deal in a generous spirit with the cases of the children.

The JURY returned a verdict to the effect that the cause of death was poisoning by gas, and added: "We believe the Corporation were careless, through their officials, as, had the supply of gas been cut off sooner, the man's life might have been saved."

Sympathy was expressed on behalf of the Coroner, the Jury, the Gas Committee, and the Corporation, with the bereaved family.

THE LEEDS GASHOLDER FATALITY.

Decoration of the Rescuers.

In the last number of the "JOURNAL" (p. 900) it was stated that the King had been graciously pleased to award the Edward Medal of the Second Class to Herbert Briggs, Christopher Bywater, and Thomas Vinters, who showed great bravery in trying to save three others who were overcome by gas in a large holder at Lower Wortley, Leeds, on the 12th of August. They were decorated by His Majesty on Tuesday morning, and the "Court Circular" for that day gives the following particulars of the accident: "On the 12th of August last repairs were being carried out at Lower Wortley, Leeds, in a large gasholder 105 feet high. The holder had been emptied of gas, and two men were at work inside on a raft floating in deep water at the bottom. Feeling the effects of gas given off by the water when disturbed, they decided to climb out; and the foreman outside, thinking that something was wrong, entered the holder and descended to the raft. Bywater, who was stationed at the air-lock at the top of the holder, by which it is entered, went down to a small unrailed platform 9 feet below, from which a rope ladder 70 feet long descended to the raft. He let down a rope, by means of which one man of the three was brought up. Briggs and Vinters then made their way into the holder and on to the platform, and, with Bywater, endeavoured, but without success, to pull up the second workman. At length, owing to the effects of the gas, they had to climb out of the holder. Briggs became unconscious, and Vinters descended to the ground for help, but, being unsuccessful, he climbed back and returned inside to the platform with Bywater. Unable to do anything, they were again forced to come out—Bywater beginning to lose consciousness. Further assistance then arrived. After steps had been taken, with the assistance of Vinters, to lower the holder and to revive the men suffering from gas (the holder had fallen nearly to the ground level), a number of men entered, and succeeded in bringing out the two men remaining within; but attempts to resuscitate them were unavailing. Briggs, Bywater, and Vinters deserve much credit for their plucky action. Exposed to the effects of gas, and running risks of falling from the unprotected platform, in which case no assistance could have reached them, they did their utmost to save the three men at the bottom of the holder; and, while unsuccessful in two cases, effected the rescue of the third."

MUNICIPAL ADVERTISING OF GOODS.

Two complaints against Committees of the Birmingham Corporation were made at the Chamber of Commerce meeting last Wednesday.

The first had reference to advertising gas-mantles. The Imperial and Local Finance Committee reported: "Your Committee have had under consideration a complaint as to the action of the Gas Committee of the Corporation in recently attaching to gas accounts a slip stating that they had arranged for the supply of 'Standard' gas-mantles; that such mantles were strong and durable, and might be relied upon to give good lighting results; and that there were 'none genuine without the accompanying design on the box.' . . . . It would seem to your Committee that the advertising, and especially the guaranteeing by a Corporation Department, of a particular article is open to very serious objection. But before reporting further on the matter, your Committee have instructed the Secretary to make inquiries of the Corporation Gas Department as to the extent to which they propose to carry the system of advertising particular goods manufactured for use in connection with the supply of gas."

The other complaint referred to an exhibition of goods sold by a particular firm by the Electricity Supply Department and stated: "The attention of your Committee has been called to a special electrical exhibition recently organized by a firm domiciled out of Birmingham 'in conjunction with the City of Birmingham Electric Supply Department.' The words quoted were used in an illustrated catalogue issued by the firm, which bore also a representation of the City Arms, and a list of charges for electricity, to which was attached the name of the City Electrical Engineer and Manager, and other particulars relating to the Electricity Supply Department. . . . It would appear from the illustrated catalogue, and also from an inspection of the exhibition itself, that there were few (if any) exhibits which could not be produced by reputable Birmingham firms. On the other hand, there was nothing to show that all the goods exhibited were the products of local or even of English firms. . . . With the view of enabling your Committee further to consider the matter, your Secretary has been instructed to inquire of the Electricity Department as to the extent to which they at present propose to carry the policy of helping particular firms to advertise their commodities."

The report was approved.

CLARK'S Patent SYPHON STOVES

Convincing Testimony.

Dr. Lessing after a 3 months' practical and scientific test states:

"A natural ventilation and even distribution of heat all over the room."

"No deleterious effects from the products of combustion when using the stove in rooms or confined spaces."

"Your Syphon Stoves can be thoroughly recommended on account of the complete utilization of the gas burnt."

Prompt Delivery.

CLARK'S SYPHON STOVE CO., LD.

Originators and Inventors,

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Factory: Warrington, England.

The PHŒNIX.

COKE DISPOSAL.

By Robert Watson, of Doncaster.

[From the December Issue of the British Commercial Gas Association Bulletin.]

General interest is, at the present time, being shown in the coke question; and this fact should make for improvement in the state of affairs. There is some reason for serious efforts being made, not merely to reduce stocks, but to maintain fair prices for this residual, in view of the high cost of coal. So far as actual stocks are concerned, the condition of things is not materially worse than in 1909; but the trouble this year is that the ratio of the price of coke to that of gas coal is not the same, and there is difficulty in selling at proportionate figures.

The present comparatively heavy stocks have been brought about by several contributing factors—some beyond and others within the control of the gas industry. The main reasons are, probably, the increased production of gas coke due to the larger quantity of gas manufactured; the partial shutting down of carburetted water-gas plants following the high price of oil; the competitive supplies in some districts of small coke from colliery coke-ovens as a result of a greater use of the latter; the gradually growing loss of the custom of portland cement manufacturers; and like influences.

It is quite possible, however, that most of the trouble has been caused by only one or two of the above factors, and the partial disuse of carburetted water-gas plants has been a very important element. This is suggested by a comparison of the stocks held this autumn and that of two years ago. Obviously, 1912 conditions, affected as they were by the coal strike, cannot be considered. Statistics indicate that the increase in gas-coke stocks over those of 1911 is about equal to the coke which would be thrown on to the market if carburetted water gas production were reduced to the extent of 15 to 20 per cent. for a period of only six months.

It is difficult to say to what degree such cessation took place; but the proportion stated is easily possible. If so, it would seem that with the resumption of the full use of carburetted water-gas plants, further increase in stocks need not be anticipated. Happily, signs are not wanting that such resumption is taking place from motives of policy, and it is now helped by the possibility of obtaining oil at more reasonable figures.

The President of the Institution of Gas Engineers has done useful service in drawing attention to the advisability of maintaining carburetted water-gas production to the full rather than increasing yard coke stocks, and in pointing out that the easier price of oil does not now create a much worse position than was the case a few years ago. Judging from recent inquiry, oil at the present time can be obtained at a price not much greater than the average price of 3¼d., which Mr. Allen states ruled for fourteen years prior to 1909, during which period probably the great majority of plants were installed.

Although, obviously, conditions are not the same for all undertakings, the situation for carburetted water-gas manufacturers, and indirectly for gas-coke producers generally, would appear to be more hopeful.

While on one hand more gas coke is being produced, there are one or two industries where the use of this fuel is falling off. The malting industry at one time absorbed some 250,000 tons per annum; but although a good deal of this custom has gone, the loss has been sustained for some time, and comparisons for the past few years are not materially affected.

The usage of coke in the production of portland cement is, unfortunately, becoming gradually less. Five years ago it was estimated that 3,000,000 tons of portland cement were produced in the United Kingdom; and of this, two-thirds were manufactured in ovens using coke to the extent of 800,000 tons per annum. This year the estimate, obtained from a reliable source, is 3,250,000 tons, half of which is manufactured by stationary kilns employing coke, and the other half by rotary kilns using coal. Hence, on a basis of 8 cwt. of coke per ton of cement, 150,000 tons of coke per annum have been displaced, compared with the year 1908.

These instances are given to show that although coke stocks may not be greater than they have been at times, it is imperative for every gas undertaking, large or small, both for the sake of their markets and the prices realized, to advocate the advantages of coke as a good and useful fuel.

While the non-supply by many undertakings of specially prepared coke for household and special purposes may not be a direct factor in the present situation, it can be looked upon as an important reason why there is not a better market for gas coke.

It is remarkable that so little is done in this phase of activity. There are grounds for saying that probably half the gas undertakings in the kingdom have not as yet fully undertaken the sale of broken coke. There may be, and are, some places where there is no necessity for this, because the ordinary coke is all easily taken up. Whether in that case better prices could not be obtained is, of course, a question for individual undertakings, in view of local conditions. The provision of prepared coke at every gas-works in the country would, nevertheless, materially help matters. This is not a case of mere altruism, because the work will pay the undertakings concerned by the realization of a higher average price for the commodity supplied.

As indicated last month [*ante*, p. 614], the experience of the commercial section proves this to the full. Figures are before the writer which indicate that in the area covered by one Commercial Section the total "outside" sales, in spite of the increased production of coke, decreased in three years by some 2 per cent., equal to nearly 12,000 tons; and this was coincident with an increasing supply of broken coke in the home districts. This effect is also suggested by similar figures from another important section, where the total broken coke supplied by the gas-works undertaking this class of custom had risen from 13·2 per cent. to 15·8 per cent. of their output.

The members representing the gas undertakings concerned report

"VOLCANIC" (Powder). "VOLCUM" (Paste).

Andrew Stephenson,

Tel. Address:
"VOLCANISM, LONDON."

171, Palmerston House,
Old Broad Street,
LONDON, E.C.

LEST YE FORGET.

that the sale of broken coke has undoubtedly increased their local demand, and such testimony is gratifying, in that it suggests a very useful solution to the problem of coke disposal.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The North British Railway Company have been adding to the list of stations where they use high-pressure gas. They commenced with the Leith Goods Yards, and now have inaugurated the scheme which has been adopted at Portobello, which is one of the largest, if not really the largest, marshalling yards in Scotland. The gas is taken from the Edinburgh and Leith Corporations Gas Commissioners' mains—the Railway Company having ceased to manufacture their own gas, which they did for many years. The power for the Portobello installation is obtained from a gas-engine: and the gas is delivered to a series of 30 lamps extending for a length of about a mile up to Joppa. The lanterns are fixed at a height of 25 feet, each having a single inverted mantle. The lamps light all the important junctions; so that the operation of marshalling will be speeded up, and the dangers to the shunters much reduced, owing to the greater ease in coupling-up when there is plenty of light. The plant has been installed in duplicate to avoid breakdowns, as these would mean serious stoppage of work and delay in starting trains.

When we find a large Railway Company in Scotland taking up this principle of increasing gas pressures, we may be assured that they have first thoroughly satisfied themselves that the plan is feasible and also economical. This should form a good advertisement for high-pressure gas, were it not that the general public will look upon it as electricity, and not trouble to inquire regarding it. Some means of calling attention to the fact is required, so that all who run may read and know how these effects are obtained.

The town councils who own their gas-works, having got over their elections, have been busy—first, in choosing their bailies, and, secondly, the various councillors to sit upon the different committees. In most cases the convenership remains in the same hands as last year. This is a wise decision, as, despite the well-known ability of the average councillor to take up any municipal subject, from fever or phthisis to gas, water, and sanitary departments, each of which is a life-study to those who have real knowledge of any of these matters, the convenership should certainly be in the hands of one who has served some time upon the gas committee, and will therefore have at least some knowledge of the plant. How many of the gas committee will attend a lecture when it is delivered by their own manager or an outside lecturer? An attendance at many lectures, of both kinds, has shown that, with the exception generally of the chairman of the evening (usually a councillor), the interest of the remainder is shown by their absence.

Kirkcaldy is not to have a free hand with its Provisional Order, as the Fife County Council fear the roads might be affected if the Corporation are allowed to supply gas outside the burgh boundaries. They have therefore appointed a Committee to take the necessary steps to oppose the Order, if considered advisable.

The Falkirk Town Council have again had a lively discussion regarding the gas-works. For some time past there has been trouble in the district from naphthalene, and, like other places, this has been specially visited by this bugbear of the gas manager during the recent cold snap. The Gas Committee recommended that a Sub-Committee should be formed to look into the matter; but the whole Council discussed the question at length, and it was then suggested that the Manager (Mr. W. Wilson) should first make inquiries of other gas managers and report to the Gas Committee. This was finally, by the casting vote of the Provost, the finding of the Council. In the course of the remarks, many of which were very wide of the question, there was reference to the Sub-Committee having to visit other towns to see what is being done there, and objection was taken to the expense of these visits. There is no question that some town councillors are fond of travelling about at the expense of the ratepayers; but it is doubtful whether any really good purpose is served by the visits, or anything of value obtained by the ratepayer in return for the money expended. Councillor Sinclair showed a good knowledge of the subject when he said "naphthalene is one of the best things to have in the gas if they could keep it there, but one of the worst things to have in the gas-pipes." This is a very pithy way of stating the fact, and one which will appeal to all gas managers. Unfortunately the councillor was not understood by his hearers, who generally showed a lack of elementary knowledge as regards gas matters. Dean of Guild Stevenson bore testimony to Mr. Wilson's good and faithful service, and was emphatic that the Sub-Committee were not to interfere with him in any way. The usual complaint about the reduction in candle power from 20 to 14 was raised, and this tended to seriously prolong the discussion.

The Lanarkshire County Council held a special meeting to approve of the promotion of the Lanarkshire Gas Order (1913), and to remit it to the Parliamentary Bills Committee, with the full powers of the Council, to take such action as they may consider advisable in connection therewith. The Clerk, Mr. Munro, stated, in reply to a councillor, that the Order only conceded that which Parliament had intended as far back as 1894, but which could not then be gone into owing to faulty draftsmanship. The Order enabled the District Committee and the County Council, with all due precautions, to buy gas undertakings at a fair price—in fact, it put the Council in the same position as burghs.

Lucy Blunt, a married woman, asphyxiated herself at Nottingham a few days ago by placing her head in a gas-oven the burners of which were turned on. She had suffered considerably from ill-health; and the Coroner's Jury returned a verdict of "Suicide while temporarily insane."

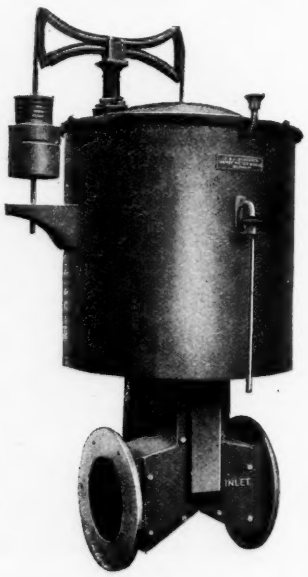
BRADDOCK'S RETORT-HOUSE GOVERNORS

HAVE PROVED TO BE

SECOND TO NONE.

Many repeat orders have been received.

Braddock's New Patent Retort-House Governor is a further improvement and is especially desirable for use with Vertical Retorts.



No. 284.
Braddock's New Patent Enclosed Retort-House Governor, Latest Type.

Further Particulars upon Application.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), **Globe Meter Works, OLDHAM.**

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 815.

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Telegrams: "METRIQUE, LONDON." Telephone No. 2412 HOP.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Dec.* 20.

Throughout the week the tone of the market for this material has remained quiet, but there has not been any further decline in prices. New business has not been plentiful, but the requirements for covering contracts made previously for December shipment have proved sufficient to absorb all parcels offered for sale. At the close, the nearest values are £12 16s 3d. per ton f.o.b. Hull, £12 17s. 6d. per ton f.o.b. Liverpool, and £13 per ton f.o.b. Leith. For future delivery it is reported that some producers have now modified their ideas, and that they have accepted £13 2s. 6d. per ton f.o.b. good ports over the early months of next year.

Nitrate of Soda.

The market for this article is still unchanged, and holders repeat quotations at 10s. 6d. per cwt. for ordinary and 10s. 9d. for refined quality, on spot.

Tar Products. LONDON, *Dec.* 22.

There is little or no alteration in the markets for tar products. Business is somewhat quiet; but, of course, this is not unexpected at this time of the year. For the forward position, prices are steady; but consumers appear somewhat nervous to make contracts very far ahead. Pitch remains about the same, though it is very hard to sell abroad at the equivalent of to-day's quotations. The market at the present moment is a difficult one, and all are now waiting for the turn of the year for further developments. Benzols remain steady, and distillers show no inclination to reduce their price for next year's delivery. Solvent and heavy naphthas are quiet, and there is little or no business doing. Crude carbolic has again quietened, and makers will not sell at the present figures. Creosote maintains its price.

The average values during the week were: Tar, 27s. 6d. to 31s. 6d. Pitch, London, 40s. to 40s. 6d.; east coast, 39s. to 40s.; west coast, Manchester, 39s. to 40s.; Liverpool, 39s. 6d. to 40s. 6d.; Clyde, 39s. to 40s. Benzol, 90 per cent., naked, London, 1s. 1d. to 1s. 1½d.; North, 11½d. to 1s.; 50-90 per cent., naked, London, 1s.; North, 11d. Toluol, naked, London, 10½d. to 11d.; North, 10¾d. to 11d. Crude naphtha, in bulk, London, 5½d. to 5¾d.; North, 5d. to 5¼d. Solvent naphtha, naked, London, 10½d. to 10¾d.; North, 9½d. to 9¾d. f.o.b. Heavy naphtha, naked, London, 10d. to 10½d. f.o.b.; North, 9d. to 9½d. f.o.b. Creosote, in bulk, London, 3½d. to 3⅝d.; North, 3d. to 3⅛d. Heavy oils, in bulk, London, 3⅜d. to 3⅝d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 1d. to 1s. 1½d. Naphthalene, £4 10s. to £10; salts, 55s. to 60s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit; "B" quality, nominally ¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

A very dull week has again been experienced, and orders abroad are being taken at lower prices than those quoted on this side. Outside London makes are quoted at £12 2s. 6d.; Hull, £12 16s. 3d. to £12 17s. 6d.; Liverpool, £12 17s. 6d. to £12 18s. 9d.; Leith, £12 18s. 9d. to £13; Middlesbrough, £12 17s. 6d. to £12 18s. 9d.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade is active; and as more settled weather has allowed steamers to arrive more regularly, the shipments of coal are heavier in the last few days—production at the collieries being full. In steam coals, best Northumbrians, for prompt shipment, are from 14s. 9d. to 15s. per ton f.o.b.; second-class steams are from 12s. 6d. to 12s. 10d. per ton; and steam smalls are from 6s. 3d. to 8s. per ton—the latter class being plentiful at present. In the gas coal trade there is a keen demand for early supply. The quoted price for best Durhams is 15s. 6d. per ton f.o.b.; about 13s. 6d. to 14s. per ton for seconds; and from 15s. 6d. to 16s. per ton f.o.b. for "Wear Specials." The tenders have been sent in for the Paris gas coal; but there is nothing yet known with certainty as to the prices. Tenders are also invited for some 20,000 tons of coal for the Riga Gas-Works. At present, there is little coal free for early sale; but for forward supplies there is some disposition to look for lower prices. In coke, quotations are generally firm. Gas coke is abundant, with values naturally easier; good makes being from 16s. to 17s. per ton f.o.b.

Scotch Coal Trade.

The coal trade throughout Scotland continues to be busy in all its branches, and there is a strong demand for all grades. With the incoming week, on account of the New Year's holidays there will be a cessation of work for several days at the pits. On the Glasgow Coal Exchange during the latter part of the past week, the following were the prices quoted: Ell, best brands, 13s. 9d. to 14s.; splint, 13s. 9d. to 17s.; Navigations, 15s. to 16s. 9d.; steams, 13s. to 14s.; Hartleys, 16s. 6d.; trebles, 12s. 9d. to 13s.; doubles, 12s. 3d. to 12s. 6d.; singles, 11s.; pearls, 9s. to 9s. 3d.; dross, 7s. to 7s. 9d.—f.o.b. Glasgow.

On the occasion of a recent deputation of representative commercial men to the Chairman of the Board of Inland Revenue (Sir Matthew Nathan) on the subject of income-tax adjustments, he pointed out in regard to the regularization of depreciation allowances, that the Board had already made a good start, and had agreed upon certain rates in the cases of the shipping industry, paper-mills, tramways, electrical undertakings, railway waggons, printing offices, and gas-works; and he said he took it that, if the Association of Chambers of Commerce would get their trades to send representatives to settle these matters, they would add to the benefits already conferred on traders.

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Social Gatherings of Gas-Works Employees.

As we are now in what is generally regarded as the "festive season," reports reach us of social gatherings of employees in gas-works. Last Thursday about eighty of those of the Grays and Tilbury Gas Company were entertained by the Company, under the presidency of the Chairman (Mr. F. E. Bartlett). A musical programme was arranged for the first part of the evening, and the remainder was devoted to a whist drive. Thanks were accorded to the Directors, on the motion of the Engineer and Manager (Mr. A. W. Sumner). On the same evening the employees of the Littleborough Gas Company had their annual social gathering. Mr. J. C. Hudson, the Chairman of the Company, presided, and a programme of vocal and instrumental music was gone through. The Manager and Secretary (Mr. S. E. Halliwell) proposed "The Directors," and in doing so referred to the many evidences they had of the interest shown by the Board in the welfare of the employees. A Committee had been elected to organize schemes to foster social intercourse between the men; and during the year an excursion had been arranged, garden competitions had been held, and also the annual social, all of which tended to encourage a spirit of co-operation. Dining-rooms, bathroom, and lavatories had also been provided, which were much appreciated. Mr. Hudson responded and proposed "The Manager, Secretary, and Staff." Mr. Halliwell, in acknowledging the toast, said the successful working of the Company was largely due to the loyal co-operation of the whole of the staff.

New Joint-Stock Companies.—The following joint-stock companies have lately been registered: Automatic Stove (Parent Company), with a capital of £3000, in 2800 shares of £1 each and 4000 shares of 1s. each, to carry on the business of manufacturers of automatic gas-controllers for stoves. Power Gas Economy, Limited, with a capital of £10,000, in £1 shares, to adopt an agreement with Messrs. K. Huessener and T. M. Hunter. Sydney's Lighting Experts, with a capital of £1000, in £1 shares, to carry on the business of lighting engineers and fitters.

Failure of an Incandescent Burner Dealer.—The Official Receiver has issued particulars under the failure of Harry or Herman Maisner, described as "H. Maisner and Co.," dealer in incandescent mantles and patent gas-burners, carrying on business at 103, Great Saffron Hill, E.C. The receiving order was made on Oct. 16 [see *ante*, p. 462]. The statement of affairs disclosed gross liabilities of £10,973. The net amount expected to rank for dividend was returned at £9272, there being fully secured creditors for £1698, holding securities estimated at £3150. The net assets, after deducting the claims of preferential creditors, were returned at £13,974. There was a surplus of assets over liabilities of £4701. Debtor attributed his failure to creditors having pressed him in consequence of their having received some anonymous letters bringing charges against him, to his inability to obtain the leases of certain properties, to loss on trading, and to extravagance.

Westbury (Wilts) Gas Company.

The annual meeting of this Company was held on Monday last week—Mr. H. W. Mead in the chair. The Chairman, in moving the adoption of the report and accounts, observed that the increased price not only of coal, but of metals and all kinds of material accounted for some additional expenditure; but, with the aid of improved apparatus and working, and better sales for residuals, the Directors were able to meet this without contemplating an increased price of gas. The balance available for distribution was £832; and the Directors recommended a dividend for the half year ended the 30th of September at the rate of 8 per cent. per annum on the original, and 5⅜ per cent. on the new capital. Looking at the state of things generally in the district, and at the advances in the price of coal and iron, he considered there was some reason to be thankful that they were able to recommend the usual rates of dividend. The Managing-Director (Mr. N. H. Humphrys) seconded the motion, and in doing so he pointed out several special features in the accounts. He remarked that, when comparisons were made with the works in the neighbouring towns, it should be remembered that at Westbury they had a straggling and comparatively poor district to supply, and were at a disadvantage in many other respects. After a short discussion, the motion was carried unanimously. The Chairman said he was sure the meeting greatly appreciated the services rendered by Mr. Humphrys, as well as those of the whole of the staff. He moved a cordial vote of thanks to them. The motion having been carried, Mr. Humphrys acknowledged the vote on behalf of himself and as representing the staff. He said the kind expression of approval of their services by the shareholders would be valued by all.

Gas v. Electricity for School Lighting at Clitheroe.—At the last meeting of the Clitheroe Town Council, the Clerk read a communication from the Lancashire County Council with reference to the lighting of a new secondary school by electricity. The letter stated that the Architectural Sub-Committee had not favourably considered the matter of electricity, and were recommending that the school should be lighted by "incandescent arrangements." Their experience was that in an electric installation of the character proposed, the initial cost was great, and also that it proved expensive later on.

Success of Automatic Lamp Lighting in Newcastle.—According to a paragraph in the "Newcastle Daily Chronicle" on Monday last week, the report of the estimated income and expenditure of the Corporation Lighting Committee, which had just been issued, showed that there had been a saving of £784 18s. 2d. For the twelve months ended March, 1913, £23,432 was required for the lighting of the public streets, whereas £25,190 was needed for the twelve months ended March, 1911, prior to the inauguration of the automatic system of lighting and extinguishing. The illuminating power throughout the city has been increased by 13·87 per cent. The Committee, the Inspector (Mr. Lamb) says, are to be congratulated on the satisfactory results of the automatic system—the "A & M."

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Increase in Price at Northampton.—The great rise in the cost of coal and the increase of wages have compelled the Northampton Gas Company to raise the charge for gas 2d. per 1000 cubic feet as from Christmas. The advance, however, does not apply to gas used for power purposes; and the discount of 10 per cent. for prompt payment will be continued as before. In an interview, the Engineer (Mr. G. S. Eunson) stated that the last reduction in price was made in the summer of 1911, when it was lowered to 2s. 2d. per 1000 cubic feet; but during the last two years there has been an increase in the cost of coal equal to 4d. per 1000 cubic feet. The cost of wages and materials has also gone up. For a time, enhanced coke prices gave some relief; but now that coke has fallen considerably, there is nothing to counteract the greater cost of coal.

Birmingham Gas and Water Supply.—Mr. R. C. Maxwell, one of the Local Government Board Inspectors, concluded an inquiry at Birmingham last Friday into an application by the Corporation to amend certain sections of Local Acts relating to the water undertaking. The Town Clerk (Mr. E. V. Hiley) stated that on more than one occasion recently the distribution of water exceeded the amount received by the aqueduct from Wales. The Corporation therefore asked the Local Government Board to sanction a loan for a third pipe and other works from time to time as they might be required. They also asked for power to fix the scale of charges to be used in the city and elsewhere within their limits, in substitution for the scale fixed by the Consolidation Act. With regard to the Gas Department, the Corporation applied for authority to substitute the No. 2 "Metropolitan" burner as the prescribed burner to be used for testing the illuminating power of the gas. There was no opposition to the proposal of the Gas Committee; and the Inspector agreed to recommend the sanctioning of the Model Bill clause regarding the No. 2 burner.

Electricity and the Smoke Nuisance.—The Guildford Electricity Supply Company, Limited, were last week before the Borough Bench, on a summons for failing to comply with the requisitions of a notice requiring the abatement of a nuisance at their works arising from a chimney sending forth black smoke. It was not their first appearance, for in January last an order was made by the Court prohibiting the nuisance, and the Company were fined £2 and costs. Last week, the fine was increased to £3 and costs; and an order for abatement accompanied it. People living in the neighbourhood evince a natural objection to black smoke; and they have probably derived little comfort from the assurance given on behalf of the Company that everything possible has been done to stop its emission. The steps to be taken in future to this end are more likely to interest them.

Accident at the Nechells Gas-Works.—While the contractors for the new Dessau retort-settings at the Nechells Gas-Works of the Birmingham Corporation (to which reference was made in last week's "JOURNAL") were on Friday morning making some alterations to the dip-pipes on one of the beds which had been closed-down the previous night, there was an explosion. It was, however, of a mild character; and not the slightest damage was done to the plant. The dip-pipes were sealed half-an-inch; and two of them had been removed, while a third was slightly prised up, and probably unsealed. The holes in the hydraulic main corresponding to the two dips were covered by loose plates. There was thus, through access of air, an explosive mixture in the hydraulic main. The retort-lids corresponding to the third dip-pipe were opened, and immediately there was an explosion and a large sheet of flame. A fitter in the employ of Messrs. Leech, Goodall, and Co., and two men in the service of the department who happened to be doing some drilling on the adjoining bed, were rather badly burned, and were sent to the hospital, but were not detained.

GAS COMPANIES' STOCK AND SHARE LIST.

The Stock Exchange has had but a gloomy week, with very few bright spots to pierce the sombre clouds. Liquidation on a large scale in both hemispheres was active, and markets had no chance of standing up against it. Home Rails were about the best of them; but even there the closing prices showed a mixed array of rises and falls. Consols were in a parlous state, dropping from one depth to a lower still, and achieving a fresh record of weakness. Those who were reported a few weeks ago to have written them down to 70 on their books were not far out in their forecast. The best that can be said for the week is that the closing tendency showed better promise. The opening day was very quiet and Christmasy; and all markets were flat with shrinking prices. Rails were fairly well off—hardly moving either way. But Government issues were weak; and Transatlantics were depressed by Continental and Wall Street realizations. Tuesday was dead quiet, business being almost non-existent; and markets were dull to a degree without a ray of relief on any side. Gilt-edged were very flat, and Consols fell ¼ with a record mark of 71 7/16. Rails were lifeless and dull. Transatlantics gave an occasional flicker, but had no solid strength. Business became quieter still, if possible, on Wednesday. As a rule, things were not so particularly bad, but Consols fell another ⅛, and changed hands at 71 1/16. Rails moved but little, and that irregularly; but Transatlantics amended a bit. Thursday was a very flat day, with hardly a redeeming feature. Consols more than once marked their 71 1/16 minimum, and every gilt-edged thing was depressed. Rails had some small losses; but Transatlantics were very weak on heavy sales abroad. The Foreign Market was depressed. On Friday there were welcome signs of a more favourable turn, but it could not reach the gilt-edged market. Consols were marked more than once at 71—thus creating a fresh record of weakness. On the other hand, Rails were firm though very quiet, and Transatlantics recovered some ground aided by foreign support. Saturday was disposed to be a little more cheerful in most markets. Consols were again done at 71, though they looked rather better at the close. The final quotation was 71 to 71¼—a fall of ⅜ in the week. In the Money Market, there was a good demand, and rates were firm. Business in the Gas Market bulked only a poor aggregate; being quite on a holiday scale. Movements were few in number, and were not uniform. In Gaslight and Coke issues, the ordinary was far below its usual point of activity, and did not maintain its customary steadiness. On Monday and Tuesday 103 was marked; but on Thursday and Friday a couple of transactions were done at 101½. The closing price was 102¼—a fall of 1. The secured issues were more active than the ordinary. Business was marked in the maximum at 74½ to 75½; in the preference, at 94 to 96½; and in the debenture, at 72 to 73—a rise of ½. South Metropolitan was quiet and unchanged at 109 to 110¼; and the debenture realized 72½ and 73⅜. In Commercials, the 4 per cent. changed hands at 106½ to 107½. Among the Suburban and Provincial group, Brentford old fetched 266, British 44⅜ and 45⅝, South Suburban 116 and 116½, and (on the local Exchange) Liverpool "A" 212. In the Continental companies, Imperial marked 169 and 170 (a rise of 1), European 17 9/16 and 17⅝, and Malta 4 7/16 to 4 11/16. Among the undertakings of the remoter world, Bombay was done at 6 and 6 1/16, Hong Kong at 17 and 17⅛, Primitiva at 5 23/32 to 5 24/32, and ditto preference at 4 23/32 to 4 24/32.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 15	4	Alliance & Dublin Ord.	58–61	..	6 11 2
274,000	,,	July 11	4	Do. 4 p.c. Deb.	80–83	..	4 16 5
280,000	6	Oct. 15	7½	Bombay, Ltd.	6–6½	..	5 15 5
50,000	10	Aug. 28	15	Bourne- mouth Gas and Water { 10 p.c. B 7 p.c. Pref. 6 p.c.	293¼–294¼ / 14½–15½ / 13½–13⅝	..	5 2 2 / 4 11 10 / 4 7 3
347,500	10	,,	7			..	
75,000	10	,,	6			..	
380,000	Stk.	Aug. 14	14	Brentford Consolidated	262–267	..	5 4 10
880,000	,,	,,	11	Do. New	203–203	..	5 5 9
50,000	,,	,,	5	Do. 5 p.c. Pref.	111–113	..	4 8 6
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	91–93*	..	4 6 0
217,380	Stk.	Aug. 28	11	Brighton & Hove Orig.	201–206	..	5 6 10
244,200	,,	,,	8	Do. A Ord. Stk.	149–152	..	5 5 3
630,000	20	Sept. 26	12½	British	44⅜–45⅛	..	5 9 11
120,000	Stk.	June 27	4	Do. 4 p.c. Deb. Stk.	87–89	..	4 9 11
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	91–93	..	4 6 0
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	2⅜–4⅜	..	—
100,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	75–80	..	5 12 6
157,150	Stk.	Aug. 14	5	Chester 5 p.c. Ord.	109–111	..	4 10 1
1,513,280	Stk.	Aug. 28	5/9/4	Commercial 4 p.c. Stk.	106–108	..	5 1 2
660,000	,,	,,	5½	Do. 3½ p.c. do.	102½–104½	..	5 2 0
475,000	,,	Dec. 11	3	Do. 3 p.c. Deb. Stk.	70–73*	..	4 3 4
800,000	Stk.	,,	4½	Continental Union, Ltd.	79–82*	..	5 9 9
200,000	,,	,,	7	Do. 7 p.c. Pref.	121–123*	..	5 13 10
492,270	Stk.	—	5⅔	Derby Con. Stk.	123–125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	102–104	..	3 16 11
1,002,180	10	July 30	10	European, Ltd.	17–18	..	5 11 1
16,386,660	Stk.	Aug. 14	4/17/4	Gas-light and Coke { 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref.	101–103	–1	4 14 7
2,600,000	,,	,,	3½		74–77	..	4 10 11
4,062,235	,,	,,	4		93–96	..	4 3 4
4,674,850	,,	Dec. 11	3	Coke { 3 p.c. Con. Deb.	71–73*	+½	4 2 2
258,740	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.	88–90	..	5 11 1
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Oct. 15	11	Hongkong & China, Ltd.	16⅜–17½	..	6 7 6
131,000	Stk.	Sept. 11	7½	Ilford A and C	150–153	..	4 19 8
65,780	,,	,,	6½	Do. B	118–120	..	5 2 1
65,500	,,	June 27	4	Do. 4 p.c. Deb.	89–91	..	4 7 11
4,940,000	Stk.	Nov. 13	9	Imperial Continental	167–172	+1	5 4 8
1,235,000	Stk.	Aug. 14	3½	Do. 3½ p.c. Deb. Red.	83½–85½	..	4 1 10
900,342	Stk.	Aug. 28	6½	Lea Bridge Ord. 5 p.c.	118–121	..	5 3 4
561,000	Stk.	,,	10	Liverpool United A	210–212		4 14 4
718,100	,,	,,	7	Do. B	146–148	+3	4 14 7
806,083	,,	June 27	4	Do. Deb. Stk.	95–97	..	4 2 6
63,480	Stk.	June 27	3	Maidstone 3 p.c. Deb.	66½–68½	..	4 7 7
75,000	5	Dec. 11	6	Malta & Mediterranean Met. of Melbourne { 4½ p.c. Deb.	4⅜–4⅞* / 97–99	..	6 3 1 / 4 10 11
250,000	100	Oct. 1	4½				
541,920	20	Nov. 27	4	Monte Video, Ltd.	11⅜–12½	..	6 10 8
1,775,892	Stk.	July 30	4½	Newc'tle&G'tesh'd Con.	98½–99½	..	4 10 6
529,705	Stk.	June 27	8½	Do. 3½ p.c. Deb.	83½–84½	..	4 2 10
55,940	10	Aug. 28	7/10/6	North Middlesex 7 p.c.	12½–13½	..	5 11 5
300,000	Stk.	Nov. 27	8	Oriental, Ltd.	120–125	..	6 8 0
60,000	5	Sept. 26	10	Ottoman, Ltd.	7⅞–8⅛	..	6 1 3
60,000	50	Aug. 14	13	Portsea, Island B	127–130	..	5 0 0
100,000	50	,,	12	Do. C	120–123	..	4 17 7
249,980	5	Oct. 15	8	Primitiva Ord.	5⅜–6⅛	..	6 8 0
499,960	5	June 27	5	,, 5 p.c. Pref.	4⅛–5⅛	..	4 17 7
521,600	100	Dec. 1	4	,, 4 p.c. Deb.	92–94	..	4 5 1
346,198	Stk.	June 27	4	River Plate 4 p.c. Deb.	88–90	..	4 8 11
275,000	5	Sept. 26	12	San Paulo, Ltd.	—	..	—
150,000	10	,,	6	Do. 6 p.c. Pref.	11–11½	..	5 4 4
125,000	50	July 1	5	Do. 5 p.c. Deb.	49–51	..	4 18 0
135,000	Stk.	Aug. 28	10	Sheffield A	222–224	..	4 9 8
209,984	,,	,,	10	Do. B	221–223	..	4 9 8
528,500	,,	,,	10	Do. C	220–222	..	4 10 1
90,000	10	Oct. 15	7½	South African	9½–10½	..	7 2 10
6,429,895	Stk.	Aug. 14	5/9/4	South Met., 4 p.c. Ord.	109–111	..	4 18 6
1,895,445	,,	July 11	3	Do. 3 p.c. Deb.	72–74	..	4 1 1
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	157–159	..	5 6 11
952,795	Stk.	,,	6	S'th Suburb'n Ord. 5 p.c.	115–117	..	5 2 7
60,000	,,	,,	5	Do. 5 p.c. Pref.	113–115	..	4 6 11
117,058	,,	June 27	5	Do. 5 p.c. Deb. Stk.	115–117	..	4 5 6
594,740	Stk.	Nov. 13	5	Southampton Ord.	100–103	..	4 17 1
120,000	Stk.	Aug. 14	7⅜	Tottenham A 5 p.c. and B 3½ p.c.	137–140	..	5 5 4
543,940	,,	,,	5⅛		115–117	..	5 0 5
149,470	,,	June 27	4	Edmonton 4 p.c. Deb.	90–92	..	4 7 0
182,380	10	,,	5	Tuscan, Ltd.	5–6	..	8 6 8
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96–98	..	5 2 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	111–113	..	4 8 6
30,000	Stk.	Aug. 28	8⅜	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	155–160	..	5 4 8
255,636	,,	,,	6⅞	,, B 3½ p.c.	130–135	..	5 1 10
108,075	,,	,,	5/17/3	,, C 3½ p.c.	110–115	..	5 2 0
352,000	,,	,,	6½	Wimbledon 5 p.c.	111–116	..	5 5 7
98 000	,,	,,	6⅝	Epsom 5 p.c.	115–120		5 10 5
88,416	,,	June 27	3	3 p.c. Deb. Stk.	68–70	..	4 5 9

Prices marked * are "Ex-Div."

Fire at the Mill Hill Gas-Works.—There was on Saturday a slight outbreak of fire at the Mill Hill works of the North Middlesex Gas Company, owing, it is reported, to some hot coke falling into a "tank of tar-coated water." The flames set fire to the woodwork of a travelling crane; and the operator, who jumped 20 feet to the ground, was removed to hospital suffering from burns and injury to the back. The fire was extinguished by the workmen.

Holywell Water Supply.—A Local Government Board inquiry was held last week at Holywell (Flintshire) relative to the application of the Urban District Council for sanction to borrow a sum of £12,374 to carry out a scheme of water supply and drainage. Mr. J. K. Roberts (Clerk) explained that ever since 1864 efforts had been unsuccessfully made to provide the town with water. Eventually the Council came to the conclusion that the only possible and satisfactory supply would be from St. Winifride's Well; and they had now entered into all agreements. He could not understand upon what grounds the opposition to the scheme was based, because he considered that there never was a case in which an application could be more justified. The supply at present is from buckets. There are no pipes whatever; and the water is sold at ½d. a gallon.

Electric Lighting Scheme for Lurgan Opposed by Ratepayers.—The Lurgan Urban District Council having adopted an electric lighting scheme, a deputation from the ratepayers waited upon them on Monday last week, and submitted figures from other places which showed that similar undertakings had been carried on at a loss. It was pointed out that at present the entire town is lighted by gas, whereas the Council proposed to light the main streets only. It was submitted that the estimate for the scheme (£11,000 or £12,000) was altogether inadequate; £20,000 being nearer the figure. It was urged upon the Council that, instead of following up the electric lighting scheme, steps should be taken to purchase the gas-works, the operation of which would, it was considered, by good management, prove to be of the best service to the town. The deputation were promised that all the information furnished should have due consideration.

Mallow Gas Manager's Dismissal.—At a recent meeting of the Mallow Urban District Council, a letter was read from Mr. A. Julian, solicitor, stating that he awaited the Council's explanation before taking legal proceedings, as instructed, regarding the summary dismissal of the Gas Manager, Mr. P. M'Dougall; this having been done at a meeting called for the sole purpose of appointing a consulting gas engineer. In a letter Mr. M'Dougall stated that he was dismissed without reason or a chance of self-defence; and he claimed that the charges against him should be duly set forth. He denied that he had put up a certain notice at the works, as to dismissing men for "carrying stories," or that he had been guilty of any "impertinence" to the Council; and he held that, as to his capability, he was willing to submit the matter to any gas expert. The Chairman (Mr. E. Fitzgerald) said Mr. M'Dougall was chosen out of a number of applicants for the managership because, on his testimonials, he was the best candidate; and Mr. Sullivan said the quality of the gas had markedly improved. The Clerk then read a series of allegations against Mr. M'Dougall, which included references to "orders for goods" and the quality of the public lighting. The Chairman said Mr. M'Dougall should have an opportunity of reply; and other members declared that an injustice had been done to him. On a division, five voted for hearing an explanation from Mr. M'Dougall, and nine against it.

The report of Messrs. James Milne and Son for the year ended the 30th of September shows that there is a debit balance of £2275, in addition to which depreciation of plant, machinery, and buildings, £1113, falls to be charged. Adding these sums to the debit balance brought forward, there is a total of £15,775 at the debit of the profit and loss account.

On the evening of Sunday, the 14th inst., the Grand Duke and Grand Duchess of Mecklenburg-Schwerin and the members of their family and suites had to leave the dinner-table hurriedly and make their escape from the famous castle at Schwerin, in consequence of a fire which had broken out. The castle was partly in ruins, and precious works of art had been destroyed, when the fire was extinguished early next morning. The total loss is estimated at £150,000. According to Court officials, the fire was caused by an electric short-circuit.

At the London Bankruptcy Court last Tuesday, the public examination was held, before Mr. Registrar Linklater, of Albert Oswald Ruscoe, gas engineer, carrying on business at Bletchley, under the style of Ruscoe and Co. The statement of affairs filed by the debtor disclosed gross liabilities amounting to £1136, of which £740 was due to unsecured creditors, and £396 to partly secured creditors. The value of the securities was returned at £40; and the assets were estimated to produce £1066. The receiving order was made on Nov. 6 [see *ante*, p. 702], on the petition of a creditor; the act of bankruptcy being the debtor's failure to comply with the requirements of a bankruptcy notice duly served upon him. The debtor, examined by the Official Receiver (Mr. Egerton S. Grey), said his failure was due to having insufficient capital, to the heavy expenses incidental to the establishment of a new business, and his liability under a guarantee. He had never failed before, or made any arrangement with his creditors outside the Bankruptcy Court. The examination was ordered to be closed.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

SALESMAN. Rochdale Gas Department. Applications by Dec. 31.
SALESWOMAN. Rochdale Gas Department. Applications by Dec. 31.
CARBONIZING FOREMAN. (Chile). J. Lumsden, 29, Cornhill, E.C.
YOUTH FOR DRAWING AND TESTING. Blackpool Gas Department.
COLLECTOR. Aldershot Gas, Water, and District Lighting Company.
STOKER. (St. John's, Newfoundland). No. 5826.

Appointments, &c., Wanted.

CONSTRUCTION ENGINEER. C.B.A., care of Streets', 30, Cornhill.

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WORKINGTON GAS DEPARTMENT. Tenders by Jan. 3.

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DARLINGTON CORPORATION. Tenders by Jan. 7.

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HARWICH GAS COMPANY, Tenders by Jan. 3.

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